

• *Timely Topics*



On
POULTRY MANAGEMENT

ELEVENTH EDITION



ISSUED BY WIRTHMORE POULTRY SERVICE DEPARTMENT

Timely Topics

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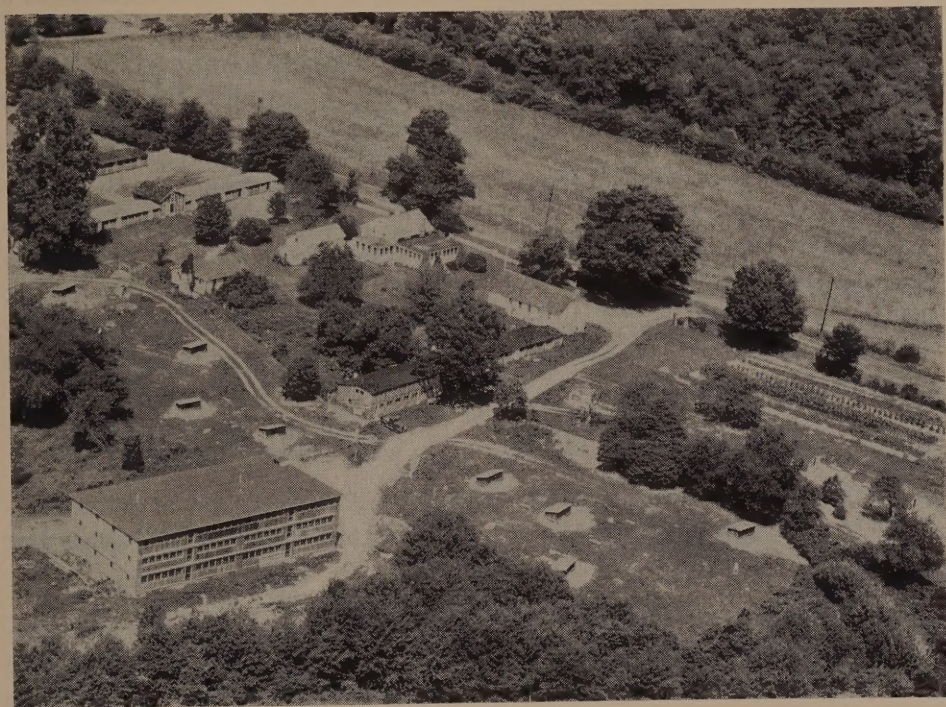
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Poultry Economics



The Poultry Industry

Commercial poultry production in the Northeast has been experiencing a period of vast expansion and it is safe to say that for many years to come a further steady growth of this modern industry may be expected.

There have been many reasons for this expansion. Over one-third of the total population of the country is concentrated in the Northeast. Such large consuming areas as Boston, New York, Philadelphia, and the hundreds of other industrialized cities and villages all go to make up the best marketing region of the world.

Poultry raising, whether a part time or full time occupation, is a type of farm business that is easily adaptable to a wide variety of conditions, such as the amount and topography of land, and the size and type of buildings. Regardless of the size of the operation, it offers a relatively fast turnover of working capital.

Individual hard work and know-how throughout the industry have been responsible for providing the consumer with fresh, high quality products. Credit must also be given our many extension, research, pathological, and service staffs which have guided the poultry industry through recent periods of expansion.

In addition to the above contributions that have led to this expansion, a portion of the development has been due to the high level of national income, and the increasing demands of our constantly growing population. Improvements in the quality of poultry and eggs, as well as their favorable price relationship have made them very much in demand.

Today's poultry industry should be proud of its achievements. Better management and improved nutrition have played an important role in the growth of this industry, while outstanding progress has been made in poultry breeding. As a result of these physical, economic, and scientific factors, this minor farm industry of a quarter-century ago, may today boast the third largest national agricultural income, grossing over four billion dollars annually.

The Poultryman

Since the poultry business is made up mostly of small units, the man operating the farm should possess many of the personal qualifications that are necessary for success.

The poultryman should possess the quality of sound business management so that he can buy and sell advantageously. He should have the ability to make plans far in advance, keep good records and constantly be on the lookout for new information pertaining to all phases of his business.

A successful poultryman is usually a neat person with a natural liking for poultry and willing to work long hours. Mechanical ability is also very helpful so that many of the repairs on the farm buildings and equipment may be made without outside help.

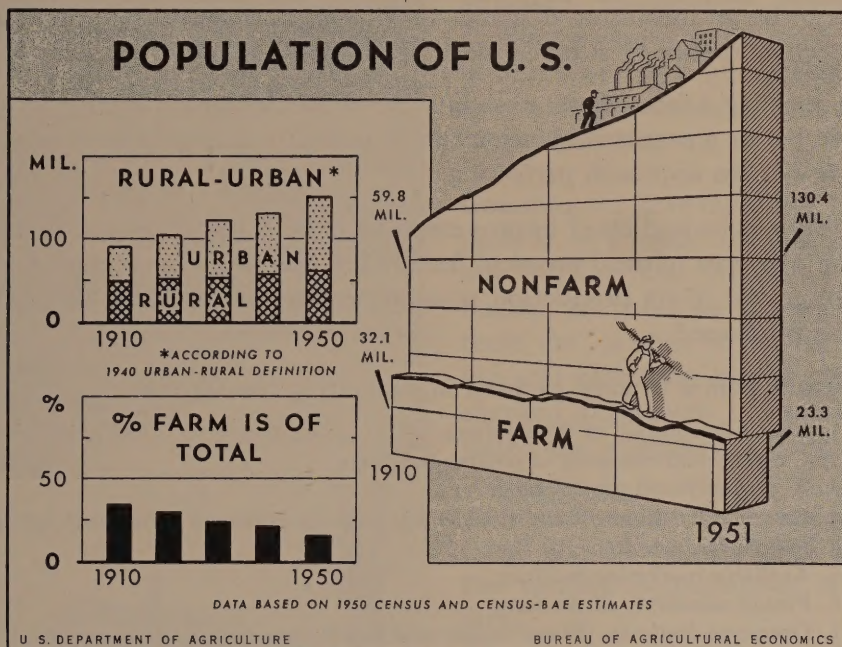
It is a combination of all these factors, plus the interest and cooperation of the farm family and those employed, that result in success on our modern poultry farms.

Poultry Farm Trends

Since poultry raising today involves an ever increasing tendency toward

greater specialization and larger farms, it is well to consider first what is responsible for this trend.

In the recent decade (1941-1951) U.S. farm population dropped approximately 20 percent, leaving nearly half of the counties in the nation with population losses. During this same period the number of city and urban dwellers increased nearly 28 percent, resulting in a greater demand for farm produce being placed on the remaining farms.



This trend toward a smaller farm population has resulted in an increasing number of larger poultry farms, and is in keeping with the stepped-up demand for poultry products. Along with this progression to larger farms there has resulted a tendency toward better labor efficiency by the use of larger pens and mechanical equipment, greater production efficiency through scientific breeding, and improved feed efficiency through application of modern nutritional research.

The expansion and greater efficiency in recent years have allowed the poultryman to keep his per unit cost down to a minimum, and have aided in smoothing out the ups and downs of fluctuating market prices. Many poultry farms today have laying house capacities from 2000 to 10,000 birds, while the broiler producers have capacities from 5000 to 40,000 broilers. These plants are largely a result of expansion during the recent post war period and represent sizeable investments.

The following questions are of interest to everyone in this industry. Can

the prospective buyer afford to purchase one of these larger farms? What methods are used for arriving at a fair selling price for the farm? What facilities are there available for financing the farm?

Many other questions might also be asked, some of which can be answered at this writing and others which only the future can answer.

Choosing the Poultry Farm

Many poultry farms have changed hands since World War II and there seems to be an increasing demand during this period for the family size farm, which requires less investment in land, buildings and equipment.

In purchasing a farm there are a number of factors which should be considered before a proper evaluation can be made. It should be kept in mind that few farms approach perfection.

Building repairs and other improvements can be made as profits warrant, but unfavorable natural physical factors are not easily overcome. A correct appraisal of its production possibilities should be made before the farm is purchased.

Important points to keep in mind in evaluating the farm are:

1. Size and condition of the dwelling.
2. Capacity and efficiency of poultry buildings.
3. Availability and type of range.
4. Presence of equipment and stock which might provide new owner with self-sustaining business from the start.
5. Available marketing facilities.
6. Future saleability of the farm.
7. Operating facilities. (Water supply and power lines.)
8. Social factors. (Church and schools.)
9. Neighboring factors. (Airport, railroads and factories.)
10. Possibility of future expansion.

Land For Poultry Raising

In nearly all types of farming, the available acreage of cleared land is thought to be of major importance. This is partly true of poultry farming. However, with the advent of larger poultry houses there has been a steady trend toward confinement rearing, resulting in less emphasis being placed on ranging facilities. In spite of this fact, a range comprised of light to medium soil which drains easily, is a desirable asset and an aid to sanitation. Land that is capable of carrying a good grass sod when properly seeded should easily accommodate 500 birds to the acre.

With land values at their highest peak in history, the buyer should strive to maintain a proper balance between the investment in useful acreage and the investment in buildings. A minimum of ten acres is desirable for a poultry farm.



Buildings

In making an appraisal of a poultry farm, it should be kept in mind that the amount of loan approved by most lending agencies is largely determined by the location and value of the farm dwelling. Large poultry houses and other buildings although representing necessary production value to the buyer are usually appraised at a relatively low value when compared to their replacement cost.

Checking the farm buildings for repairs is very much like appraising any dwelling and the advice of a builder in checking foundations, roofs, etc., is often advisable. Wiring and plumbing should also be checked along with the source of water and adequacy of supply. If the farm is a large commercial plant with several large buildings, these should be thought of as the earning potentialities of the farm.

Since modern laying houses will accommodate larger flocks more efficiently, the narrow one-story buildings have become less desirable. These houses may be used for brooding until larger units can be constructed from earnings, or until they can be remodeled.

Many barns, factories, and other buildings have been remodeled at less than half the cost of new buildings with equivalent floor space. Remodeled barns have played a part in the development of the larger two and three story houses.

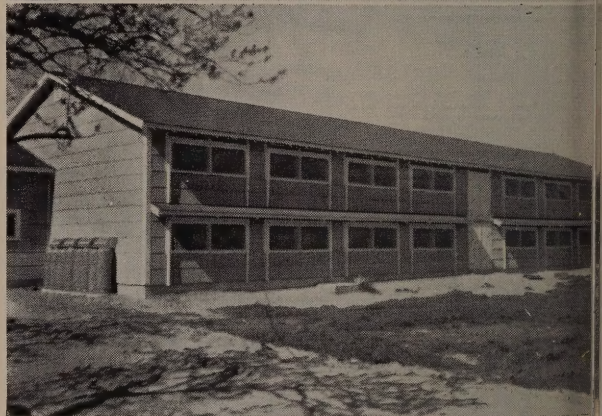
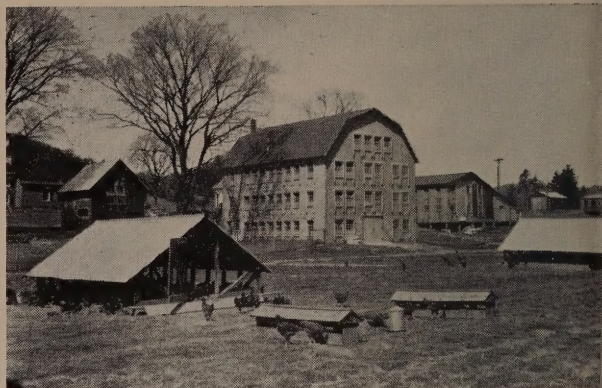
Building Costs

Approximate building costs of constructing new poultry houses of various sizes were compiled at the University of Connecticut, and are given on page 7. It should be kept in mind that building costs vary considerably in different areas and that costs per square foot of floor space vary according to size and number of stories. Large deep houses have relatively less outside wall area and foundation per square foot of floor space. Multiple story houses reduce foundation and roof costs per square foot of floor area.

Poultry House Construction Estimated on a Sectional Cost Basis

(Cost estimates are based on lumber figured at \$70.00 per thousand and other costs in proportion)

- | | |
|--------------|---|
| Foundation — | Grading, footing, drains, and cement floors
Estimated cost 40¢ to 60¢ per sq. ft. |
| Side Walls — | Studs, matched boards, insulation and brick siding
Estimated cost 40¢ to 60¢ per sq. ft. |
| Roof — | Shed roof, rafters, matched boards, and insulation
Estimated cost 50¢ to 80¢ per sq. ft. |
| Floors — | Posts, carrying beams, floor joists and boarding
Estimated cost 35¢ to 45¢ per sq. ft. |
| Utilities — | Watering and lighting facilities, nests, and feeders
Estimated cost 15¢ to 20¢ per sq. ft. |



Cost estimates apply to brooder and laying houses alike. Two cost estimates are given in the following table. The first assumes the poultryman will be his own builder, shopping for materials, hiring and supervising labor; the second figure is close to contract cost. Variation in construction and material is allowed, but cost estimates are based on insulation to maintain a room temperature above freezing under Connecticut conditions.

¹ Poultry House Construction Cost Table Per Square Foot Floor Space Comparing Houses of Different Sizes, Heights and Types

(These cost estimates are based on lumber at \$70 per thousand and other costs in proportion)

Story	Size	Cost	Story	Size	Cost
1	24' x 24'	\$1.54 to \$2.33	1	40' x 40'	\$1.37 to \$2.07
2	24' x 24'	1.26 to 1.82	2	40' x 40'	1.09 to 1.57
3	24' x 24'	1.17 to 1.66	3	40' x 40'	1.00 to 1.41
1	24' x 96'	1.35 to 2.06	1	40' x 80'	1.29 to 1.95
2	24' x 96'	1.08 to 1.55	2	40' x 80'	1.01 to 1.45
3	24' x 96'	.98 to 1.39	3	40' x 80'	.92 to 1.29
1	30' x 30'	1.45 to 2.21	1	48' x 48'	1.31 to 2.00
2	30' x 30'	1.17 to 1.70	2	48' x 48'	1.04 to 1.50
3	30' x 30'	1.08 to 1.20	3	48' x 48'	.95 to 1.33
1	30' x 90'	1.32 to 2.00	1	48' x 96'	1.25 to 1.90
2	30' x 90'	1.04 to 1.50	2	48' x 96'	.97 to 1.40
3	30' x 90'	.95 to 1.33	3	48' x 96'	.88 to 1.23
1	36' x 36'	1.40 to 2.13	1	50' x 600'	1.18 to 1.80
2	36' x 36'	1.12 to 1.62	2	50' x 600'	.92 to 1.30
3	36' x 36'	1.03 to 1.45	3	50' x 600'	.82 to 1.14
1	36' x 108'	1.28 to 1.95	1	90' x 500'	1.13 to 1.73
2	36' x 108'	1.00 to 1.44	1	100' round	1.17 to 1.79
3	36' x 108'	.91 to 1.27	1	150' round	1.13 to 1.73

Houses 24', 30', 40' and 48' deep are flat roof, $1\frac{1}{2}''$ pitch per 1'. Gable roof houses having 35°-45° pitch, would cost 12¢ more for 1 story; 6¢ more for 2 story; and 4¢ more for 3 story houses. Houses 50' and 90' deep are low double pitch roof, 1'' pitch per 1'. Round houses have a cupola in the center, roof pitch 1'' per 1'. All houses have full south windows, 24' houses $\frac{1}{4}$ north windows; 48' houses $\frac{1}{2}$ north windows; 90' houses full north windows; round houses have windows all the way around. Omitting cement floor, side wall insulation and roof insulation will cut costs 15¢ to 40¢. Costs can be cut only by leaving out something.

¹Tables and recommendations prepared by Mr. Roy Jones, former Extension Poultryman, University of Connecticut.

If the prospective buyer is interested in broiler raising, the preferred type of house throughout the Maine and Delmarva broiler areas is the wide, equal span structure, in comparison with the preferred shed-roofed buildings found in many areas of southern New England. Many of these newer houses are from 36' to 48' wide, and from 100' to 300' long, housing from 5000 to 20,000 birds. Cinder blocks are often used for sides and ends, when costs are favorable.

In estimating the capacities of a particular building, approximately one square foot of floor space should be allowed for broilers to twelve weeks, and from two to three square feet of floor space for layers. During summer months many poultrymen allow only two square feet per layer, since proper ventilation and dry litter are more easily maintained during this period. It is now accepted practice to allow less floor space per bird in larger houses, than was previously thought to be advisable.

How Much Should The Farm Cost?

The common way to arrive at a selling price for any farm is to compare the farm with others that have been sold or are for sale in the area. Farm value, like the value of any business, should be measured principally by the income and profit potentialities, both present and in the future.

Farm income in the poultry business fluctuates a great deal from year to year. Therefore, if the buyer possesses the background of specialized training or experience in this field, he can undertake the purchase of a farm with more assurance of success than the person who first must obtain the "feel" of this business. It is best for the inexperienced to begin in a small way and gradually work into a larger business.

The investment in a poultry farm including land, buildings and equipment for the combined replacement and laying flock, will represent from \$9.00 to \$12.00 per layer capacity. These figures do not include the cost of a dwelling. When broiler raising is considered the investment would be about 10% as much per bird as in the case of the laying flock.

Agricultural Financing

Poultrymen, like most all businessmen, need credit to finance their businesses at one time or another. The two types of loans used to take care of these credit needs are: (1) real estate loans used to purchase a farm and, in some instances, to remodel or construct buildings, and (2) non-real estate, or operating loans used to cover production costs, purchase of equipment, etc.

Real Estate Loans

The principal lending agencies in the farm-mortgage field in the order of volume of loans outstanding as of January 1, 1952, are: (1) individuals

and miscellaneous lenders, (2) insurance companies, (3) commercial and savings banks, (4) Federal Land Banks, and (5) Farmers' Home Administration.

Most of the loans held by insurance companies are granted directly to the farmer. In some instances banks that are short of loanable funds act as representatives of insurance companies so as to be able to extend mortgage credit to their farm-customers. Such loans are frequently for a longer term than some banks can offer.

Federal Land Banks are under the supervision of the Farm Credit Administration. In some sections of the West they have a larger volume of farm real estate loans outstanding than do commercial banks; in the East and for the nation as a whole they have a smaller volume outstanding than do commercial banks.

The Farmers' Home Administration loans to those who are unable to obtain credit from other sources at interest rates not more than five percent and at terms prevailing in the locality. This agency grants rehabilitation loans to farm operators as well as loans designed to aid farm tenants to buy farms.

With the exception of the Farmers' Home Administration and loans to veterans under the G.I. Bill of Rights, the interest rates and repayment schedules on mortgage loans vary widely. Farmers' Home Administration's loans are repayable in a maximum of 40 years at four percent interest; loans partially guaranteed by the Veterans' Administration are at four percent interest and may have a repayment period up to 40 years. Federal Land Banks' interest rates vary in the different Farm Credit Administration's districts and repayment periods are usually 20 or 33 years. Interest rates on commercial bank loans vary according to the prevailing rate in the locality. The length of the repayment period depends on whether or not the lending institution is a national, state, or savings bank and also upon the policies of the individual bank.

Non-Real Estate Loans

The volume of credit granted by poultry, feed, building supply and other dealers is not known, although it is probably the largest single source of short-term credit to farmers. The cost of the credit from this source is also difficult to ascertain because frequently included with the interest charges are fees for services other than for the use of money.

Next to dealers the principal agencies for non-real estate loans, in order are: commercial banks, production credit associations, and Farmers' Home Administration. Other than the credit extended to farmers by dealers, commercial banks are by far the largest sources of short-term agricultural credit, although production credit associations make a substantial

number of non-real estate loans. A small amount of short-term credit is granted by the Farmers' Home Administration including emergency crop and feed loans and disaster loans.

Summary

When a poultryman needs either a real estate or an operating loan, he should study carefully how much money he needs, what he is going to do with it, and how he plans to repay it. With this information he should approach a lending institution of his choosing and talk it over with the officer in charge of loans. It would be well to take with him a statement of his assets and liabilities as well as a statement of income and expenses for the previous year.

Lenders would prefer to say "yes" rather than "no" to an applicant. If the applicant is responsible, has a well-thought-out program and can give assurance of being able to repay his loan from the expected income he will receive, his chances of getting a favorable verdict are good.

A common mistake is to borrow from the bank or production credit association money to grow, say, replacement pullets. Then the poultryman switches plans and uses those funds to build a new poultry house, gets additional credit from the lumber dealer and depends on credit from the grain dealer to grow the replacements. Frequently the result is that he can pay neither the bank nor production credit association, the lumberman nor the grain dealer, and finds himself in financial difficulty. He should have used mortgage credit for the construction of the new poultry house because it requires a longer time to repay than do funds made available from an annual operating loan.

Remember the rule: It is almost always wise to hitch the type of credit to the use the borrower makes of the money. Use short-term credit for operating needs and use mortgage credit for capital purposes such as major additions or major repairs to buildings, or to buy a farm.

In conclusion, there are many agencies and associations from which loans may be obtained. It is important that the borrower does business with an understanding agricultural credit institution. Above all other factors the mortgage should be non-callable or one that cannot be demanded so long as the agreed to schedule of payments is met. The mortgage should allow pre-payments to be made during prosperous years and it should provide payments on the principal and interest that are in keeping with the earning potential of the farm even during unfavorable economic periods.

Types of Poultry Farm Enterprises

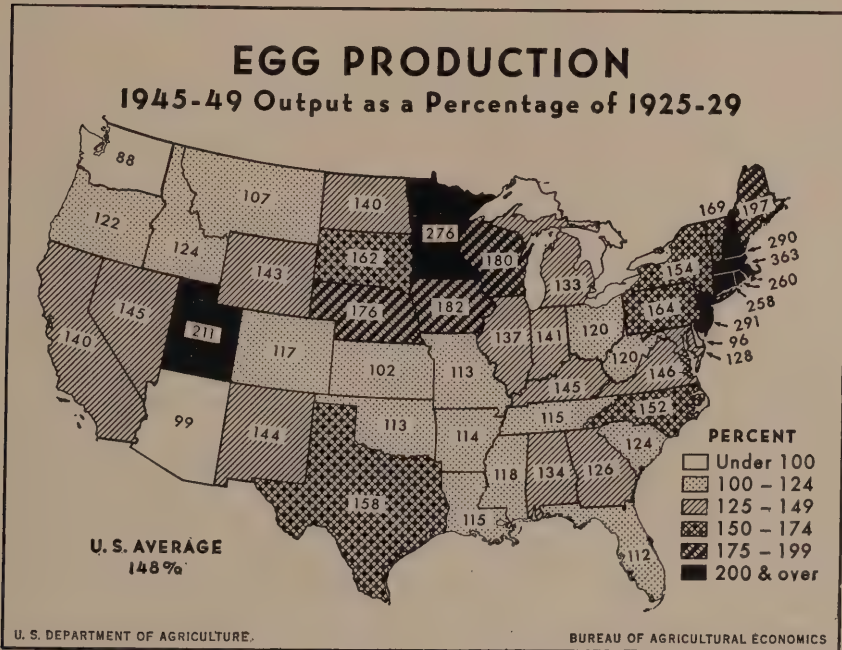
There are five major fields of poultry operation: (1) Market egg production, (2) Hatching egg production, (3) Breeder farms and hatcheries, (4) Commercial hatcheries, (5) Specialized poultry meat production.

Many poultrymen are successfully engaged in two or more of these fields. However, the tendency has been toward only one type of operation being carried out on most farms. This trend has led the way toward greater efficiency in utilization of buildings and equipment, more skillful production, and better control of poultry diseases. Regardless of the type of poultry enterprise undertaken, a knowledge of poultry husbandry and poultry marketing is desirable.

Market Egg Production

The production of table eggs for the 152 million consumers throughout the country, provided about 60 percent of the gross national poultry farm income in 1951.

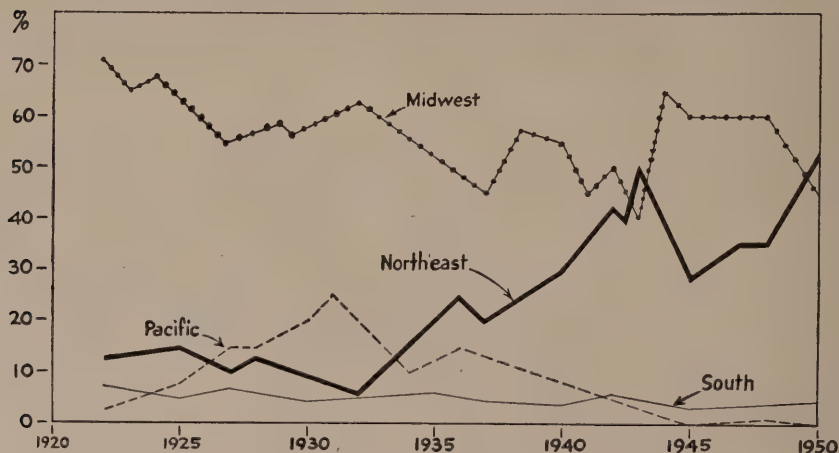
The stepped-up population and consumer demands have stimulated rapid increases in total egg production in recent years. Percentage increases in total egg production by states, for the twenty year period from 1925-29 through 1945-49, have been compiled by the Bureau of Agricultural Economics and are shown on the map below. This map points out that the egg producing business has grown tremendously in the North Atlantic states largely because of their nearness to the vast markets of Boston, New York, and Philadelphia.



Since there has been a steady change in the geographic production of eggs arriving monthly at these three larger eastern egg markets, Dr. Wendell

Earle, Department of Agricultural Economics, Cornell University, has compiled a graph showing this trend. The graph shown below, indicates that while the receipts of eggs coming from the North Atlantic region comprised of New England, New York, New Jersey and Pennsylvania, made up only 10 percent of the total in 1931, this same region furnished well over 50 percent of the total eggs received at these eastern markets in 1951.

COMPETITION IN EASTERN EGG MARKETS

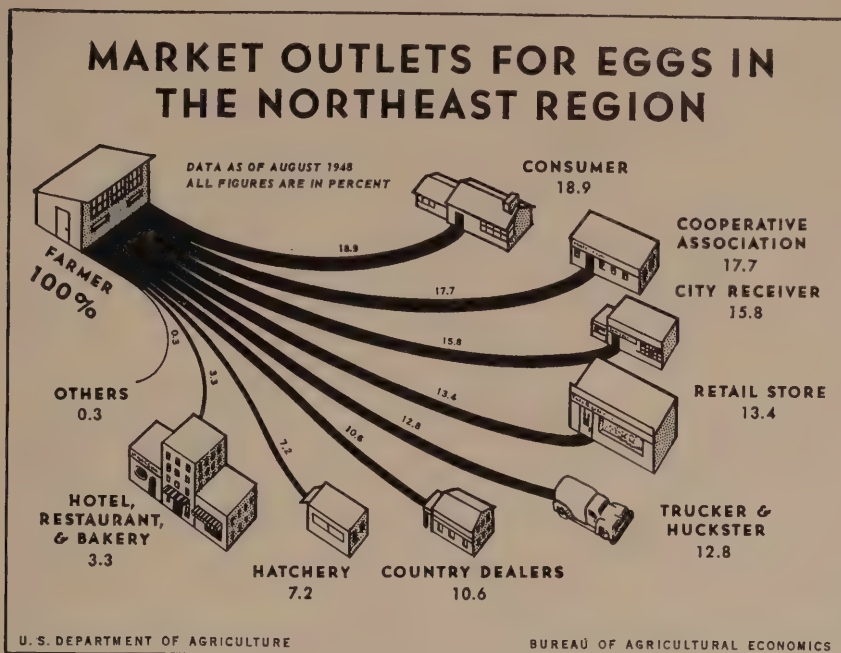


Graph shows trend in shell egg receipts from principal production areas

However, while the eastern producers have increased their total egg production to more fully supply the demands of nearby markets, the mid-westerners too have made increasing gains. These North Central States produce approximately one-half of the total U. S. supply of eggs and ship to virtually all the markets throughout the country.

A factor in recent years which has particularly aided the distribution of quality table-eggs from these midwestern points has been the availability of refrigerated truck transportation. Less damage risk, greater speed and flexibility of deliveries, with generally lower rates, have combined to make truck shipments much preferred. This system gets mid-western eggs into eastern markets in a fraction of the time that it took previous freight deliveries. Thus, it should be kept in mind by those selling locally in deficit producing areas, that the quality of midwestern eggs is greatly improved, not only because of faster transportation facilities but also because most shipments sent east today have been graded on a quality basis.

In all regions there is a great variety of outlets for the sale of eggs. In a U.S.D.A. survey conducted in 12 northeastern states, questionnaires were mailed to a sample group of poultrymen during August, 1948. Replies from nearly 13,000 were received of which 8,000 had laying birds while the survey was being conducted.



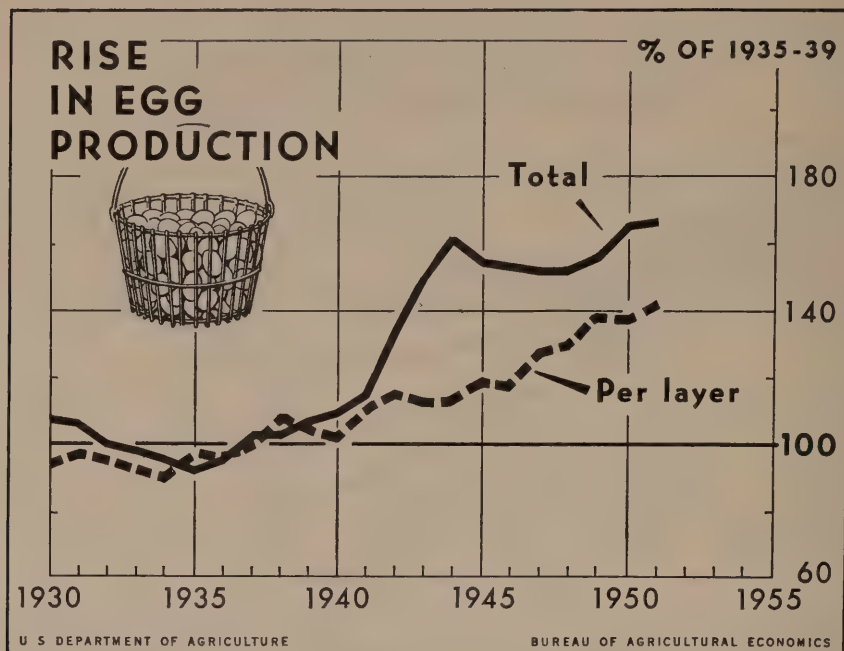
Survey shows that over one-half of all eggs produced are sold to consumers, cooperative associations, and city receivers

Sales direct to consumers, city receivers and cooperative associations made up the larger groups chiefly because most producers with larger flocks sell to these latter two groups.

During the period of this survey about 70 percent of those with flocks of 400 or more birds sold to more than one marketing outlet. Nearly half of all those reporting in this northeastern area sold some or all of their eggs directly to consumers. Slightly over 7 percent of the eggs being produced by those reporting were shipped as hatching eggs.

Hatching eggs returned the highest prices, while receipts from direct sales to consumers, hotels, and restaurants ranked next in line. Country buyers, truckers, and retail stores returned the lowest prices in each area covered by the survey. Although prices received from the first mentioned sources were higher, it should not be taken that net yearly income from eggs sold to these marketing outlets was always greater.

Probably the most important single factor that has enabled the poultry industry to fulfill these market demands has been the phenomenal rise in egg production per bird. In 1951, the estimated total egg production according to B.A.E. figures was 52 percent above the egg output of 1930, as is shown in the chart following. However, U.S.D.A. estimates of hens and pullets on farms January 1, 1951, were only approximately 2 percent larger than of January 1, 1930. Thus approximately 50 percent of the

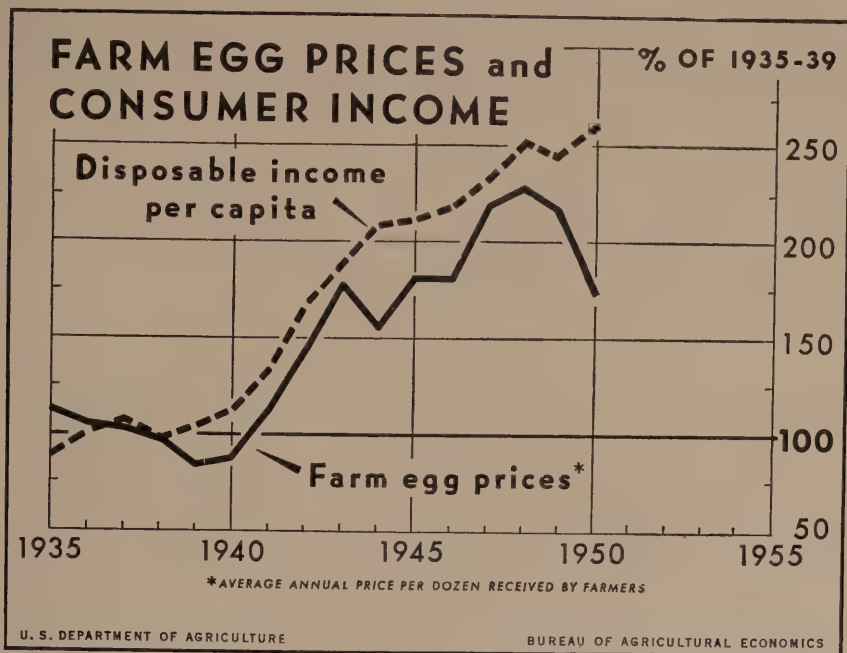


estimated 52 percent increase in total egg production during this period was accounted for by the stepped-up rate of lay per bird. This increasing rate of egg production per bird over the past 20 year period has nearly offset the increasing population and consumer demands. Improved standards of breeding, feeding and management have all played a role in this increasing rate of lay.

Government economists are presently predicting a population increase of around 40 million people in the 25 year period from 1950 to 1975. This offers a still greater challenge to the poultry industry. In order to keep up with this estimated boost in our population, at the 1950 consumption rate, production per laying bird will either have to be stepped up by 43 eggs a year, or 83 million additional layers will be needed.

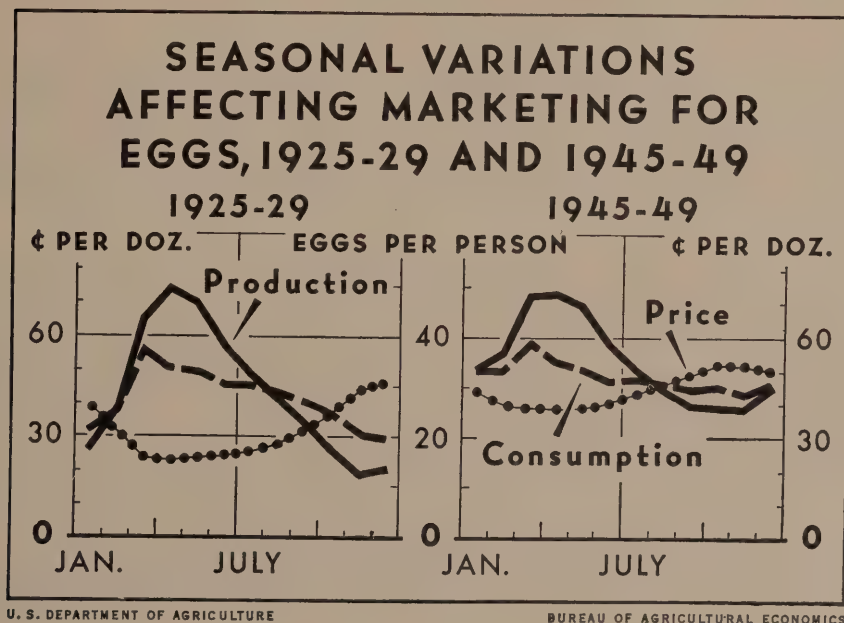
The strongest influencing factor upon which these estimates will depend is the level of consumer income that will be maintained throughout the coming years. As is shown in the B.A.E. chart at top of next page, the annual farm egg prices have rather closely followed the general upward curve of consumer income, with the exception of a few years, such as 1950, when an over-supply of eggs caused prices to dip below average.

Egg prices fluctuate on a yearly as well as on a seasonal basis. When egg prices are high in relation to feed costs in the spring, there are more replacement chicks purchased resulting in a larger supply of eggs to be marketed during the fall and winter months. This over-supply of eggs in the late fall and winter has a depressing effect on prices with a smaller



hatch of replacement chicks usually resulting the next spring. When this smaller hatch of chicks comes into production in the fall, somewhat higher prices are usually in effect the following winter and spring, resulting again in a larger hatch of replacement chicks.

In spite of frequent moderate price periods in the winter and spring,



farm egg prices through the summer and fall are usually relatively high. It is during this higher egg price period in the summer and fall, that poultrymen should try to produce the largest possible volume of eggs.

Hatching Egg Production

The production of hatching eggs has become a very important phase of the poultry industry throughout the North Atlantic region and progress is being made in other areas. Hatcheries which supply chicks to the broiler areas, as well as for replacement flock purposes, offer markets for hatching eggs.

Often the question is asked by poultrymen as to whether it is more profitable to produce hatching eggs than it is to produce market eggs. The hatching egg producer has expenses that are not incurred in the production of market eggs. The cost of buying, rearing, and feeding the males and their mortality and depreciation during the hatching season are all items of additional expense. These males will eat about the same amount of feed as an equal number of layers, with the males having a lower market value than the females when sold. It is also often necessary to maintain an additional group of males to assure high fertility during the summer months. A breeder ration must also be fed which incurs an additional cost in order to maintain desirable hatchability. Pullorum testing is another added cost of producing hatching eggs. The presence of males in the pens usually results in a little lower production, added mortality, and slightly lower meat value of the females. It is often necessary to keep strains which have desirable meat characteristics but which do not produce as heavily as other strains. However, in such cases a higher premium is usually paid to compensate for this factor.

In addition a hatching egg producer must give his flock more care in feeding and management and should have the best of egg holding facilities. Hatching eggs should be sold for at least six months of the year at a reasonable premium over table egg prices to compensate for the extra cost of production.

The hatching egg premium usually averages from 20 to 35 cents per dozen over the current wholesale table egg price for large eggs. However, if hatching eggs are accepted below the standard weight for large eggs, they are usually classed as large eggs as far as price is concerned. Another incentive for the hatching egg producer is the extra bonus which is sometimes paid for high hatchability. These factors have made the production of hatching eggs a profitable operation in many areas. It should be kept in mind that the length of time that the eggs will be taken by the hatchery is just as important as the premium paid.

Since production costs vary, and because of changing economic condi-

tions, it is difficult to set a flat figure for the additional cost of producing hatching eggs. The following outline presents a method of determining costs, returns, and necessary volume for the profitable production of hatching eggs.

*** The Major Additional Costs and Returns of Producing Hatching Eggs**
(per 100 female unit for 6 months production)

The Expenses

Depreciation of Males

8 males at start (at going price for breeders)	.....	
6 males at end (at stag prices)	.....	.....

Feed of Males

Av. of 7 males x 90¢ feed for rearing and 6 mos. in breeding pens.	.....	
x going breeder ration price	.....	.....

Additional Cost of Breeder Ration

100 females x 50¢ breeder mash (6 mos. feeding)	.....	
x price differential between breeder and laying mash	.....	.....

Bloodtesting and Handling Charges

108 x local charge	.....	
Extra labor for handling	.....	.....

Sacrifice in Production

Reasonable annual egg production per bird normally used	.....	
Anticipated production per bird from breeder stock	.....	
Difference in production	.....	
Multiply above by 100 birds, and divide by 12 to get dozens	.....	
Multiply the above number of dozen by the average market price	.....	.....

Sub-Total of Measurable Expenses

Intangible Expenses

Possibly add 10% to sub-total for intangible expenses to include the following:	.....	
Higher labor cost in more frequent collections	.....	
Added expenses involved in better holding facilities	.....	
Reduced capacity to accommodate males (questionable)	.....	
Lower market value of females	.....	

Total Additional Cost for Producing Hatching Eggs

The Returns

Hatching Egg Premiums

Average price received for hatching eggs, minus the average price of table eggs at the farm	.....	
Multiply the above by the number of dozen that will probably be used by the hatchery	.....	.....

Use of 22 Ounce Eggs for Hatching

Estimate the number of dozen 22 oz. eggs that will be
taken by hatchery during summer period

Multiply by the difference between average prices for
medium eggs and for large eggs.

Other Services to be rendered by hatchery (cases, trucking,
etc.)

Total Returns

To Figure Necessary Premium to Break Even

Divide the additional costs by the anticipated volume in doz-
ens to determine necessary premium to break even

OR

To Determine Necessary Volume

Divide additional cost by average premium to determine
necessary volume

*Formula used by courtesy Mr. Stephen Walford, Hall Bros. Hatchery, Wallingford, Conn.

Breeder Farms and Hatcheries

Specialized breeder farms have for many years been the nucleus of the poultry industry, and it is the poultry breeders operating these farms to whom this industry is grateful. Poultrymen today have been afforded outstanding production and growth rates, through the knowledge, patience, and persistent desire of the many breeders to develop and improve their strains and breeds of poultry.

We are no longer satisfied with laying flocks averaging less than 200 eggs per bird annually, or broiler flocks averaging less than four pounds in 12 to 13 weeks. It is progress such as this which reflects the ability of these breeders to develop strains of birds suited for specific purposes.

This type of poultry farming requires considerable knowledge and study since it involves the various breeding methods of flock selection, trapnesting, and progeny testing. The experienced poultry breeder finds this field constantly becoming more specialized resulting in a greater need to know more about his strain and what the public wants. Specific demands by the various specialized phases of the industry are apt to mean fewer breeders and more large, efficient breeding farms. These operations should have facilities for setting up and maintaining elaborate breeding programs, working on a large volume and selling chicks to specialized producers.

Breeders today should know how their birds will cross with other strains, since it presently appears that crosses will continue to be popular with many poultrymen. Therefore, the poultry breeder who will remain successful is one who will constantly improve his stock, be cautious in making decisions, and one who keeps abreast of a rapidly changing industry.

Commercial Hatcheries

Commercial hatcheries too are feeling the effects of greater specialization. Today many of the larger commercial hatcheries supervise their supply flocks which are largely made up of well known strains. These hatcheries are capable of furnishing a large volume of chicks when the customer wants them. Replacement stock for these supply flocks is usually purchased directly from the specialized breeder. In the future these commercial hatcheries will probably handle fewer breeds, and focus more attention on desirable strains and crosses.

Specialized Meat Production

The importance of the broiler industry can best be realized when we consider that in the past ten years broiler production has increased nearly 400 percent. Much of this increase has been concentrated along the Atlantic seaboard region, with other areas making outstanding gains in production.

Commercial Broiler Areas by States

Ranked in Order of Relative Production

1950		1951	
1. Delaware.....	81,226,000	1. Georgia.....	88,678,000
2. Georgia.....	62,892,000	2. Delaware.....	81,731,000
3. Maryland.....	54,437,000	3. Arkansas.....	69,834,000
4. Arkansas.....	49,179,000	4. Maryland.....	58,418,000
5. Virginia.....	40,033,000	5. Texas.....	50,408,000
6. Texas.....	33,383,000	6. Virginia.....	46,038,000
7. Indiana.....	27,902,000	7. California.....	39,452,000
8. North Carolina.....	25,015,000	8. Indiana.....	34,014,000
9. California.....	23,484,000	9. North Carolina.....	32,606,000
10. Mississippi.....	17,005,000	10. Mississippi.....	23,474,000
11. Maine.....	16,923,000	11. Missouri.....	22,004,000
12. West Virginia.....	15,079,000	12. Maine.....	21,145,000
13. Illinois.....	14,610,000	13. Illinois.....	18,262,000
14. Connecticut.....	14,347,000	14. West Virginia.....	17,341,000
15. Missouri.....	14,288,000	15. Connecticut.....	17,198,000
U.S. Total.....	616,185,000	U.S. Total.....	791,878,000

(Used by courtesy U.S.D.A., Delaware-Maryland Crop Reporting Service.)

The commercial broiler producer today is more dependent upon all other phases of the poultry industry than he has ever been before. This is largely because broiler raising has become big business and growers are presently operating at a high peak of efficiency. Many scientific advancements in all phases of poultry raising have greatly improved the standards upon which this industry is operating.

One of the most important factors that has led the way for the expansion of the broiler industry is the Chicken-of-Tomorrow contest, both state and

national, which has done an outstanding job of stimulating interest in the breeding of improved meat strains of chickens. Random sample tests are being conducted in several states, which show that poultry breeders are honestly endeavoring to produce the type of bird that will have more desirable meat characteristics and that will return the greatest profit per bird. These contests have prompted the broilerman to be more conscious of the number of pounds of feed it takes to produce a pound of meat.

The broiler industry has also taken full advantage of high energy type rations. Every grower realizes he must receive the best possible feed efficiency, since feed costs represent between 65 and 70 percent of the total costs of broiler production. Average feed conversion figures compiled at the National Chicken-of-Tomorrow contest, held in 1951 at the University of Arkansas appear below and give an accurate picture of the accomplishments that have been made to date.

National Chicken-of-Tomorrow Contest
Total of all Breeds and Crosses Entered

(Av. 16,000 birds straight run)

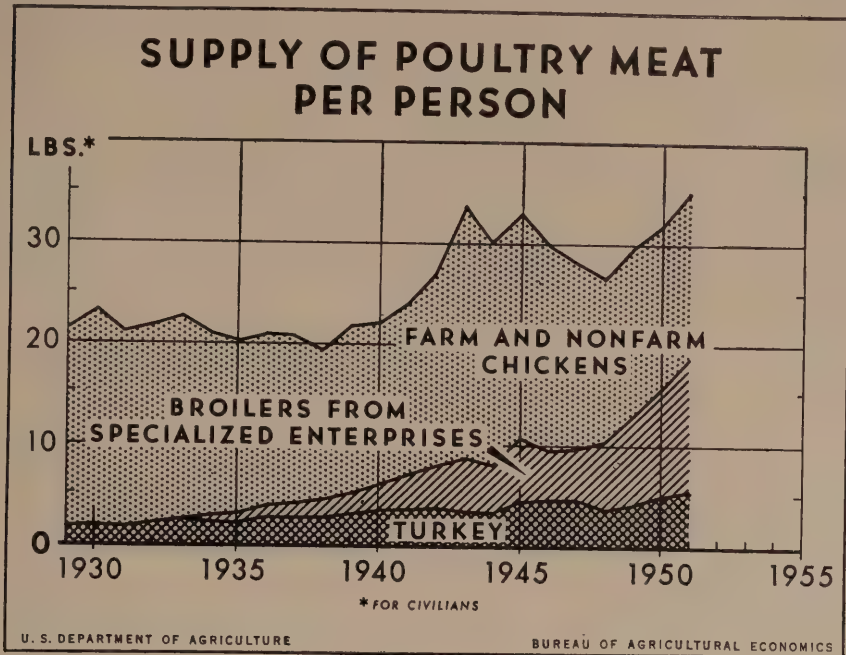
<i>Age</i>	<i>Av. Weight</i>	<i>Lbs. Feed/Lb. Gain</i>
10 weeks	3.06 lbs.	2.62 lbs.
12 weeks	3.73 lbs.	2.93 lbs.

These figures show that much progress has been made in nutritional research. Nutritionists are constantly at work seeking new improvements that will make broiler rations even more efficient in the future.

Another phase of broiler production where much progress has been made in lowering the per unit cost is in labor and housing. Mechanization and larger poultry houses allow a grower to handle several times as many birds today as he did a few years ago. Brooding has become simplified by means of central heating systems, and labor in watering and feeding has been lessened by installation of automatic waterers and mechanical feeders.

On a broader scope there are the increases in national income, population, and per capita consumption, that have greatly stepped-up the marketing potential of quality poultry meat at a reasonable price. Broilers and fryers have been supplying an increasing proportion of the U. S. poultry meat supply, until in 1951 they made up nearly one-half of all poultry meat consumed.

Most broiler growers sell their birds to live poultry buyers, auctions, or poultry dressing plants. These dressing plants process thousands of birds daily and supply the larger markets with fresh, high quality poultry meat.



There is a tendency for a larger percentage of the broilers from all sections of the country to be marketed ready-to-cook, and more freezing facilities to be incorporated, so that reserves of frozen birds may be stored during low price periods. Poultrymen who raise smaller flocks often operate a home dressing plant and sell to local markets.

A higher level of consumer spending and an increased rate of consumption has resulted in broiler expansion not only in new areas but in those already in existence.

Current high production costs and moderate market prices have not affected the continued high trend of chick placements, since yearly increases in broiler chick placements have been common. Unusually heavy chick placements occur seasonally and often result in heavy supplies of broilers being marketed two or three months later. Growers selling on these markets that are temporarily over-supplied, operate on low margins due to prevailing lower prices.

Promotion of The Poultry Industry

The entire poultry industry is grateful to the many organizations that have geared themselves to the promotion of the poultry and egg industry during the recent rapidly expanding period. The Poultry and Egg National Board, the National Poultry Producers Federation, the Northeastern Poultry Producers Council, the Southeastern Poultry and Egg Association, the United States Department of Agriculture, The State Departments of Agriculture and the many state poultry associations and exten-

sion services should be congratulated for their splendid endeavors. More publicity, with a closer relationship between all segments of the industry will be among the accomplishments of the future.

Analyzing The Farm Business

At the end of the year it has become the custom with some poultrymen to analyze their business for two purposes. The first is to find its weak points and secondly, to determine an increase or decrease in total worth. One may find the following standard of analysis helpful in overcoming possible weaknesses.

Standard of Analysis

<i>Items Considered</i>	<i>The Standard</i>	<i>Your Farm</i>
SIZE OF BUSINESS		
Wholesale egg producer	2,000 layers per man	
Retail egg producer	1,200 " " "	
Hatching egg producer	1,800 " " "	
Breeding farm	1,000 breeders per man	
Heavy meat bird producer (per year) . .	15,000 birds per man	
Broiler producer (per year)	30,000 " " "	
CAPITAL INVESTMENT		
Wholesale, retail and hatching egg producer	\$9 to \$12 per bird capacity	
Breeding farm	\$10 to \$15 " " "	
Heavy meat bird producer	\$1.50 to \$ 2 " " "	
Broiler producer	\$.75 to \$1 per bird capacity	
PRODUCTION FACTORS		
Percent of eggs produced — January thru June	Not over 50%	
Percent of eggs produced — July thru December	At least 50%	
Average yearly production	" " 60%	
Total eggs laid per bird housing capacity	" " 220	
Hatching eggs sold (percent of total daily production)	70% of eggs prod.	
Length of time all hatching eggs are sold	at least 6 mos. per year.	
FINANCIAL MEASURES		
Gross receipts	\$1 per \$1 invested	
Interest on investment	5%	
Labor income	15% to 20% of gross receipts	
Labor efficiency (receipts per \$1.0 spent for labor)	\$6.00	

Poultry Accounts

It is necessary for the efficient operation of the poultry farm to keep adequate and satisfactory records. An analysis of records at the end of the year may prompt a good operator to make changes in his program. They also help tremendously in filing complicated income tax forms, and are an important influence in the sale or transfer of property. Using them as a tool, it may become easier to secure loans from banks or other sources. Good records are an index to sound business thinking.

Poultry account books can be secured from College Extension Services. Adequate business account books can be secured from office supply houses. Poultry servicemen and county agents may be of service to help with accounting problems.

When setting up a satisfactory farm accounting system a daily record of all cash receipts and expenditures should be maintained. An inventory of buildings and land, machinery and equipment, livestock, feeds and supplies is made at the beginning of each year. Depreciation of these items should be started at a fair market value basis and written off each year at a rate which will use up the original value at the time when the item's expected usefulness is over. In analyzing the farm records at the end of the year it should be kept in mind that net *farm income* is the amount left over after all expenses are paid, including use of farm house and food products supplied by the farm. *Labor income* equals net farm income less interest on investment.

The Baby Chick

THE BABY CHICK is a complex thing — one and one-half ounces of marvelous mechanism. On the surface it is “cute”, appealing to the eye of man, woman and child alike. But underneath the soft down are many things that cannot be seen by the naked eye and that are understood by very few. Genes and chromosomes are tiny particles that in combinations determine the future of this chick in many respects. They are the all important factors governing whether this future hen shall be white, red or black in color; whether it will need four and one-half or six months to reach sexual maturity; whether it will have strong or weak broody tendencies.



"Aren't they cute?"

These factors will also determine the size of the egg it lays, its color, shape and shell texture, and many other factors over which its future owner will have a very limited control. As a matter of fact, the day the baby chick is hatched, the limitations on its future abilities in a great many respects have already been set.

What, then, can the owner of this layer of the future do about it? After the chick is in the brooder house all he can do is to give it the best care and management possible in order that it may perform up to the limit of its inherited ability to grow, live and lay. Beyond that limit he cannot go.

This chapter deals primarily with the chick that is to be grown for the purpose of laying eggs. Before discussing management factors it might be well to review some of the points

to consider when buying or hatching baby chicks. The poultryman must consider the purpose for which the eggs are produced — hatching eggs or market eggs.

Hatching Eggs

If the poultryman is a hatching egg producer, his answer to the breed and strain to be purchased can be found in a conference with the hatchery manager or flock supervisor. In the case of most breeder-hatcheries only one strain is involved. However, with many commercial hatcheries producing replacement stock and broiler chicks the problem is more complex. Commercial hatcheries must consider what will be in demand six to eighteen months in the future. The demands of the buying public change in respect to chicks as they do in other things. A new winner of the Chicken-of-Tomorrow Contest or of an Egg Laying Contest may materially change the desires of the chick buying public with the result that the hatchery must have it for sale.

Market Eggs

In the case of market eggs the poultryman must make his own decision as to the breed and strain of chicks. In making this decision he might do well to seek the advice of others.

While there are a number of breeds and production crosses available that will do a commendable job of efficient egg production, the most popular ones are:

Straight Breeds

Rhode Island Reds
Production type New Hampshires
Production type Barred Rocks
Production type White Plymouth Rocks
White Leghorns.

Production Crosses

Sex-link pullet (R. I. Red or production type New Hampshire male x Barred Rock female)
Barred Rock male x production type New Hampshire or R. I. Red female
White Leghorn male x R. I. Red or production type New Hampshire female
Other crosses. There are several crosses not listed above that have localized popularity.

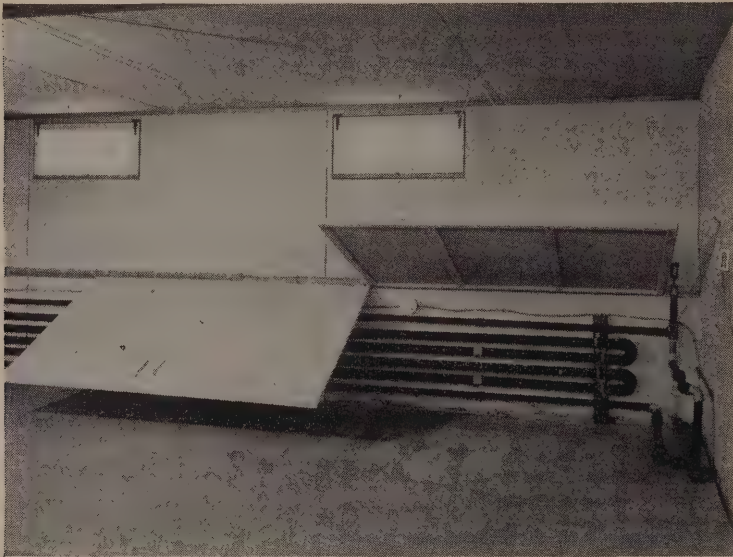
Selecting a Strain

Whether the choice is of a certain breed or of a cross, the strain of that breed is of great importance, possibly being more important than the breed. This is equally true of crosses. Some strains cross with others very well. As the poultryman expresses it they "nick" and the offspring do a good job. Others do not.

There are several ways of getting information about the particular strain of bird under consideration.

- a. Official Egg Laying Contests. The results of these contests are published regularly in the poultry press.
- b. Record Of Performance Reports. These are published in the poultry press or may be obtained from the official state agency that supervised them. Such details as number of eggs per bird, weight of egg and weight of bird may be learned from these reports.
- c. Random Sample Flock Tests.
- d. Observing a neighbor's flock.
- e. Visiting the breeder who originated the strain.
- f. Experience in handling the strain under consideration.

The latter is the final test. Many poultrymen who are considering the purchase of chicks from a certain strain buy only a few to see how they perform compared to their present strain. This method is certainly safer than making a complete change without a trial. Strains of birds perform differently in some respects under different conditions. This is especially true in respect to livability.



Hot water system with vertical tier of pipes along back wall. In some of these systems the bottom pipe of the tier is a vulcan or fin type pipe

Factors to Consider in Making Selection

Regardless of the breed, strain or cross selected there are certain points that should be studied before ordering chicks. These include:

- | | |
|---|--------------------------|
| Livability. | Body size. |
| Rate and persistency of egg production. | Rate of maturity. |
| Egg size, shell texture, color and shape. | Freedom from broodiness. |
| Rate of feathering. | |

LIVABILITY

To have some poultry mortality is apparently inevitable. To keep it at a minimum should be the goal. Every laying hen that dies represents a two-



The "ring" that shows perfect chick comfort

fold loss (a) salvage value and (b) potential profit from eggs. Together these could amount to from \$2.00 to \$2.50 per bird.

A practical standard for a poultryman to keep in mind is to house as layers 90% of the pullet chicks started and sell 85% of them as fowl at the conclusion of the laying period — in other words, a 10% mortality during the growing period and a 15% mortality during the laying period.

RATE AND PERSISTENCY OF EGG PRODUCTION

Rate and persistency of production are often thought of as being similar in meaning. From the genetic point of view they are different. The geneticist speaks of intensity (or rate) of production in a particular period such as eggs per month, average clutch size, number of eggs during first 60 days of production, etc. On the other hand, the same authority would refer to persistency of production as meaning the ability to lay for a long period before molting.

With a 2000 bird laying flock every change of one per cent in production for the laying year represents 487 dozen eggs, which, at 60 cents per dozen, means \$292.20. High production per hen also reduces feed costs per dozen eggs. This is indicated by the following chart published by the University of Maryland (for a 5 pound layer).

<i>Eggs Per Hen Per Year</i>	<i>Lbs. Feed Per Dozen Eggs</i>	<i>Total Lbs. Feed Per Hen Per Yr.</i>	<i>Feed Cost Per Dozen Eggs at 5¢ Per Lb. For Feed</i>
0	—	65.3	—
100	9.5	79.5	47.5 Cents
150	6.9	86.6	34.5 "
200	5.6	93.7	28.0 "
250	4.9	100.8	24.5 "

EGG SIZE, SHELL TEXTURE, COLOR AND SHAPE

In view of the fact that (a) egg grading laws establish certain standards for the size and shape of eggs as well as shell texture and (b) that different grades are priced differently in the market, it is obvious that these factors are of economic importance to the poultrymen.

The matter of egg size is so important to the poultryman that the pressure of competition among breeders has tended to develop strains of poultry with ever increasing average egg size. There has recently been some concern among the primary breeders that possibly this factor has been developed too far.

The color of the egg shell, while formerly of considerable importance geographically, has in recent years become less of a marketing problem.



A fan blows the hot air through flue to hovers in this automatic oil heating system

However, this might be investigated locally before changing to a breed or cross of poultry that would produce eggs with a different colored shell than formerly was being produced.

RATE OF FEATHERING

In recent years chick buyers have become "fast feathering" conscious. It is a matter of great economic importance to the broiler grower. It is a desirable asset in a flock of birds to be grown for the production of either hatching or market eggs. There is a correlation between rate of feathering and rate of growth. Feather pulling is less of a problem in fast feathering flocks. There is a difference in value per pound in favor of the fully feathered birds when sold for meat; and fast feathering chicks seem to require less heat during the brooding period.

BODY SIZE

Until recently it was generally agreed that a large bird was more profitable than a small bird, when both lay at the same rate. This was due to greater salvage value of the bigger bird when sold as fowl.

More recently two facts have tended to change this opinion: (1) Fowl brings a relatively low price per pound, especially in the heavy weights. (2) The greater efficiency of the smaller layer in using feed. These facts are shown by the following chart:

Chart based on production of 200 eggs per bird per year in each case; feed costing 5 cents per pound, salvage value of 4 and 5 pound birds at 23¢ per pound and 6 pound birds at 21¢ per pound and eggs computed at 50¢ per dozen.

	4 Pound Bird	5 Pound Bird	6 Pound Bird
* Lbs. feed per doz. eggs	5.1	5.6	6.1
* Total Feed per year (lbs.)	84.9	93.7	102.0
Feed Cost per dozen eggs	\$.26	\$.28	\$.31
Total Feed Cost per hen per yr.	\$4.25	\$4.69	\$5.10
Returns over feed cost per bird	\$4.05	\$3.61	\$3.20
Salvage Value per hen	\$.92	\$1.15	\$1.26
Returns over salvage value	\$3.13	\$2.46	\$1.94

*Figures published by University of Maryland

RATE OF MATURITY

Early sexual maturity is desirable providing good body size can be realized at first egg and that the size of egg when production starts is reasonably good. Extremes either way are undesirable.

Both early and late sexual maturity have been shown by investigators to be inherited. To determine the inherited maturity date of a strain only March and April hatched chicks should be observed. Extremely early hatching, such as December or January, hastens sexual maturity three

weeks or more than is normal for that strain. These effects are environmental and not inherited.

FREEDOM FROM BROODINESS

It hardly needs to be mentioned that broodiness in any strain of birds is an undesirable trait. In many strains and in a few breeds of birds this characteristic has been largely eliminated. It should be stated, however, that it is a difficult instinct to "breed out" of a given strain not only because it is due to two complementary dominant genes whose behavior when birds are mated is unpredictable, but also because there seems to be a close genetic correlation between broodiness and high intensity of production.



Automatic waterers on wire platforms. The gallon waterers will be removed from the pen three or four days after automatic waterers have been started

Pullorum Status

Pullorum status is another important item to consider in making chick selection. Purchasers of day-old chicks should become familiar with the terminology used in relation to the pullorum status of poultry flocks. Such terms as "pullorum tested", "disease free" and many other terms used in advertising do not necessarily indicate that the breeding flock is free from pullorum. "Pullorum Clean" and "Pullorum Passed" are the only two terms recognized by the poultry industry as designating breeding flocks free from pullorum disease.

The Department of Agriculture of each state may enter into a cooperative agreement with the United States Department of Agriculture in the National Poultry Improvement Plan whereby all poultrymen or hatcheries meeting the requirements of both state and "N.P.I.P." regulations are permitted to use the term "U.S." in conjunction with the state name such as Mass-U.S. Pullorum Clean. Many hatcheries require that their supply flocks qualify under certain ratings of the National Plan, in which case that hatchery can use both the state name and the term "U.S." in its advertising.

Definition of Terms

Pullorum Clean Flock — A flock in which all birds on the premises, five months of age or over, have passed one of the following requirements:

Two consecutive negative tests not less than six months apart.

Three consecutive negative tests not less than thirty days apart.

One negative test providing all birds in the flock came from Pullorum Clean sources.

Pullorum Passed Flock — A flock in which all birds on the premises, five months of age or over, have passed one negative test.

Breeding Flock Stages

In all breeding flock stages the flock must carry a pullorum grade such as Pullorum Clean or Pullorum Passed. The minimum grade or grades for each stage is determined by the official state supervisory agency, usually the state Department of Agriculture.

These breeding flock stages are:

Approved Flock — Flock carefully selected for (a) health and vigor, (b) productive capacity and (c) reasonable freedom from standard disqualifications.

Certified Flocks — Carefully selected females of the same quality as Approved flocks mated with R.O.P. males.

R.O.P. Flocks — Record of Performance embraces records of egg production, egg weight and body weight, made on the breeder's premises under official supervision. In some states similar records made at officially conducted egg-laying tests are acceptable to the official state supervisory agency.

Hatcheries

Breeder Hatchery — A hatchery that produces and hatches only its own eggs.

Commercial Hatchery — A hatchery that purchases all its eggs and may custom hatch eggs from other flocks of like status.

Approved Hatchery — Such hatcheries must set eggs only from Approved flocks.

Certified Hatchery — Such hatcheries must set eggs only from Certified flocks.

Types of Matings

After a poultryman has made a selection of the strain and source of birds which he feels is adapted to his type of poultry business he usually has an opportunity to choose between two or more kinds of matings:

1. Flock matings
2. Special matings
3. Old bird matings
4. Pedigree matings

The chicks from selected flock-matings are usually satisfactory for anyone desiring replacement layers. The majority of chicks purchased come under this category.

Special matings are usually made up of selected birds which are likely to reproduce more worthy characteristics than the general flock.

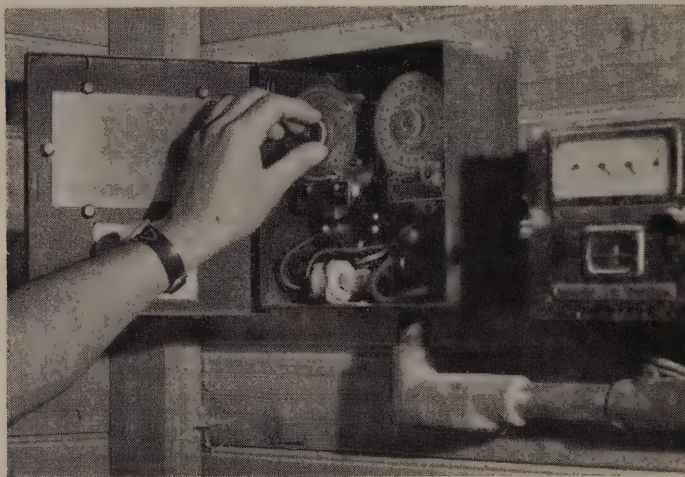
Old bird matings are often used by a breeder for the replacement of his own pullet flock. Chicks from such sources are sometimes available.

Pedigree-mated chicks are those with a known ancestry. They are particularly desirable for foundation stock.

When to Start Chicks

Chicks may be started any month of the year. The seasons of hatching may be classified as follows:

- Early hatch — December 1 to February 15
- Normal hatch — February 15 to April 15
- Late hatch — April 15 to June 15
- Summer hatch — June 15 to September 1
- Fall hatch — September 1 to December 1



An automatic time clock to control poultry house lighting saves labor

Chickens of the same strain differ in certain respects if started at different seasons of the year. Early hatched chicks grow faster and reach maturity

earlier in life than those of the same strain hatched later in the season, often by as much as four to six weeks.

Fall hatched chicks grow at nearly the same rate as early hatched birds of the same strain and require about the same length of time to reach maturity. This tendency toward early maturity can be delayed somewhat as indicated in recent experimental work reported by the New Hampshire Experimental Station. Using the same strain of fall hatched birds but changing the length of feeding day during the growing period by use of low-wattage artificial lights the station reported the following:

	<i>Daylight only</i>	<i>14 hours light</i>	<i>All-night light</i>
Days of age to 50% production	158	171	172
Eggs per bird to 44 weeks of age	97.1	84.9	85.2
% of different sizes of eggs to 44 weeks			
Under 24 oz.	72.67	70.35	58.44
24 oz. or over	27.31	29.64	41.55

The time of the year that eggs are usually higher in price is a very important factor in deciding when to start replacement chicks. Over a period of years the wholesale price of nearby Special Large eggs on the Boston market for the last six months of the year has been from 12 cents to 17 cents per dozen higher than for the first six months. Furthermore, medium-sized eggs, while worth less per dozen than large eggs at the same time, are higher in price during the summer and fall than are large eggs during the winter and spring months. This difference has been as much as $9\frac{1}{2}$ cents per dozen. This fact greatly offsets the criticism that fall and early hatched layers produce too many small eggs.

These seasonal price differences are important to the market egg producer but even more so to the hatching egg producer. The premium for hatching eggs above the wholesale egg price is usually higher in the summer than at any other season of the year. Moreover during the summer season it has become a custom to permit medium eggs to be included as hatching eggs and paid for on the basis of large eggs plus the hatching egg premium.

Why, then, don't more poultrymen produce summer eggs. Here are a few reasons:

1. It is more difficult to maintain a high rate of production during hot weather.
2. More poultry houses are needed for brooding and growing replacements during the fall and winter months. Spring hatched birds can be grown on the range, whereas fall and winter hatched birds usually cannot.
3. More fuel is used for brooding chicks in cold weather.
4. The average laying flock capacity will be reduced by about one-third in order to leave space for growing replacements in confinement.

In spite of these objections poultrymen are starting an ever increasing percentage of their annual replacements in the fall and early hatching seasons. Methods differ in some details but may be grouped roughly into one of three groups:

1. Three lots of chicks per year. When brooding space is rather limited divide the year's replacements into three hatches. One fourth is bought in the fall, September or October. When old enough to go without heat they are moved to a growing room and in January another hatch of the same size takes their place in the brooding quarters. When old enough, the second hatch is moved to the range or to growing quarters and are replaced by the third lot. This hatch can be equal in number to the other two combined if they will be moved to range when comparatively young.
2. Two lots per year. Start the number of fall hatched chicks that the brooding quarters will house up to laying age, allowing two square feet per bird. At maturity they are moved to laying pens and the brooding unit refilled with twice as many chicks as before. These are left in the brooding quarters only until they can safely go on range.
3. One lot per year. The chicks are started in December or January and sold the following December. Eggs are produced only during the summer and fall months when egg prices are most favorable.

For the poultryman desiring a rather uniform supply of eggs, such as a retailer, the first two groups suggest programs that better fit his needs. The third plan is only for the poultryman who wholesales his products.

Sexed or Straight Run

Baby chicks may be purchased as straight run, or as sexed females or males.

A majority of the growers of replacement stock purchase sexed females only. They can be purchased with a guarantee of 95% accuracy. With the majority of high production strains the males of that strain are not efficient in meat production factors. Furthermore, in the case of fall or early hatched chicks the lack of brooding space is usually a sufficient reason to restrict the purchase to females only.

Housing

A great deal of time and study should be spent in selecting the type of brooder house to be built, materials to be used, and its location. No matter what type of construction is used the poultryman should build a brooder house with an eye to the future by considering the possibility of putting layers in this house during periods when not used for brooding.

The two general classifications of brooder houses are: colony brooder houses and permanent brooder houses.

Colony brooder houses are going out of use except with the 100-500 bird flock owner and a few breeding farms. Caring for many colony brooder,



Colony brooder house

houses is hard, time-consuming work and does not make for an efficient operation.

The permanent brooder house entails so much expense in its construction, that the time spent in its planning is a good investment. Most houses are built of wood, cinder blocks, cement blocks, or a combination of blocks and wood. In the selection of material for brooder houses, price, availability, and the poultryman's ability to work these materials are matters to be taken into consideration.

Materials

Wooden houses are easier to remodel and to adjust to equipment which might be used in the future. Cinder blocks require less upkeep and have better insulation qualities than a single board wall.

In building a two-story house out of blocks some poultrymen have used a block 12" in width for the bottom floor and blocks 8" in width for the top story. This provides a shelf for the plate and joists.

Roofing materials vary considerably with roofing paper, sheet aluminum, and sheet metals being the most popular. Consideration should be given to avoiding excessive heat in the summer and conserving heat in the winter. This can be accomplished by the use of heat reflective surfaces or insulating materials.

Windows

The function of windows is two-fold — light and ventilation. Enough



Poultry houses are getting larger

light can be obtained by supplying one square foot of window space for every 25 square feet of floor space. Under most conditions this will provide ample ventilation. However, more can be provided if needed.

Windows, single sash, running in wooden tracks work very well and are easy to operate.

The top of the windows should come to or within a very few inches of the plate to facilitate ventilation.

Other Brooder House Factors

Multi-story buildings are slightly cheaper per square foot of floor space to construct, but arrangements must be made to get the feed, litter, and birds up to and down from the upper stories. Second floor delivery can be made possible by a ramp that will bring the floor of the delivery truck level with the 2nd floor.

The dimensions of an economical unit may vary considerably. A good thought to follow is the longer a house the wider it should be. A good rule to keep in mind is width of not less than 30' or more than 48'.

Many other factors must be considered. Among them are insulation for low-cost heating, providing clean-out doors and traps, foundation below frost or to load-bearing soil (hard pan), 18" footing, permanent tile under floors to carry off water spilled from drinking pans, cement floors, bolting sill to foundation and wind-bracing the walls and roof, locating house 150 feet from the laying house and designing the brooder house so it can be added to without too much expense. There is often an opportunity to remodel barns and other buildings into brooder houses.

Plans for construction of different types of houses are available and will be sent to poultrymen. Write to Wirthmore Feeds, Malden 48, Massachusetts. Your Wirthmore Serviceman is also available to advise you.

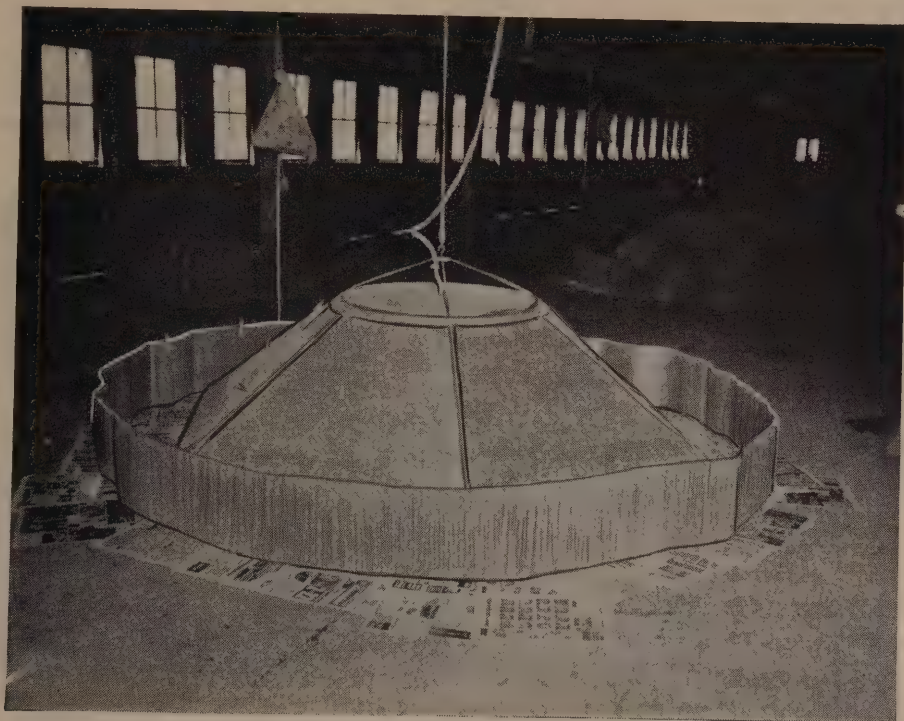
Brooder Systems and Equipment

It is obvious that the purpose of a brooder is to supply heat to keep the chicks comfortable. This can be done in many different ways. However, brooding systems are divided into two classifications: (1) individual brooders and (2) central heating plants.

Individual Brooders

There are several different types of brooder stoves — coal, oil, wood, gas and electric. The coal, oil and wood stoves heat the room as well as the area under the hover. In the spring, summer, and early fall gas and electric brooders work very well and save fuel. In the severe winter months these two types of stoves do not keep the house as warm as the other types and supplementary heat is often used.

Infra-red lamps are a rather recent development in brooding. A number of these bulbs are set up in banks a given distance from the floor depending on the amount of heat required. These bulbs heat only the surface area directly under the bulbs.



Gas brooder with papers on floor and guard set up



A compact and efficient boiler for a central heating hot water brooding system using oil. Note water circulators

Central Heating Plants

Hot Water. The hot water system is the most popular at the present time and has several variations. All of them have a boiler either oil or coal fired. A thermostat properly located in the pen regulates the temperature. In this system a series of pipes are placed horizontally in the center of the pen or they are placed horizontally or vertically along the back wall. The pipes in the horizontal placement should be 4" to 5" apart and 14" above the floor. When vertical arrangement is used the bottom pipe is usually placed 8" above the floor. The size of the heating unit, and the number and size of pipes will vary with the size of the brooding room and whether or not the

brooder house is insulated. A competent heating engineer should be consulted before such a system is installed.

Hot Air. In recent years hot air brooding has become popular. Hot air brooding is an effective method of brooding and is accomplished by heating outside or recirculated air in a special unit and conducting it to various sections of the brooder house. Such a unit circulates the air in the pen, helping to keep the litter dry and avoiding a stale air condition. A relative humidity of about 60% should be maintained. Otherwise, the system may dry out the chicks resulting in poor feathering and poor growth. Many hot air furnaces are equipped with humidifiers.

Another method of supplying hot air to the pen is through the use of space heaters which also heat the whole pen. These space heaters have a fan blowing air through a radiator heated by hot water or steam. Gas, oil or coal may be used



A hot air system that uses the small hover. Air is heated by a central heating system and blown by fans to the hover

for fuel. Space heaters are best adapted to insulated buildings otherwise the fuel cost may be excessive.

Battery Brooding

Many poultrymen brood their chicks in starting batteries for the first ten days to two weeks. After this period the chicks are usually placed in the regular brooding quarters. In cases where ideal conditions are not present in the brooder house, this practice may prove to be worthy of consideration. The temperature of the battery room should be held between 65°-70° F. At the time of transfer from the batteries great care should be given to see that the chicks make the proper adjustment to their new surroundings.

Poultrymen who operate battery plants and grow their replacement stock entirely in batteries use starting units for the first four weeks at which time the chickens are transferred to growing batteries. For further details of battery management see chapter, **THE GROWING PERIOD**, page 58.

Preparation of the Brooder House

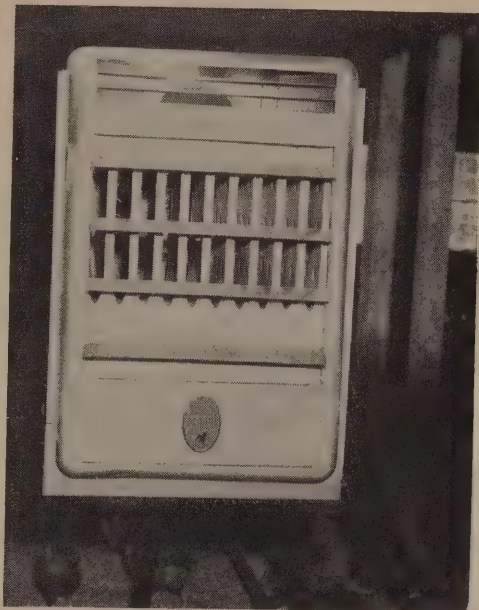
Brooder houses should be thoroughly cleaned before each new lot of chickens is started. Remove all manure and litter and sweep down the ceiling and walls. The floor should be scraped and then washed with a lye solution at the rate of one pound of lye to five gallons of hot water.

If a disinfectant containing creosote or any coal tar product is used the house should be idle and well aired for at least two weeks to evaporate harmful fumes.

Set up and operate the brooding equipment at proper temperature for three days immediately preceding the arrival of the chicks.

Litter

Many types of litter are used, such as sugar cane, ground corn cobs, peanut shells, shavings, peatmoss, sawdust or sand. Two inches make a good base to start with, except when sand is used, in which case 1 inch or even less is sufficient. With radiant heat very little or no litter is required. Newspapers spread over the litter for the first three or four days will prevent litter eating by the baby chicks. The condition of the litter is very important, much more



A gas operated space heater



Hot water brooder system. Eight 2-inch pipes are covered with building paper and insulated with shavings. Feeders and waterers are outside of hover but inside the guard

so than the type of litter used. Wet or caked litter should be removed as it occurs and fresh material added. To allow the chicks to build an immunity to coccidia the litter should not be entirely changed during the brooding period. By adding new litter every few days a deep litter may be obtained except in the case of sand. The use of hydrated lime (not land lime) or a finely ground limestone especially processed for this purpose helps prevent wet litter. One pound to each three or four square feet of floor space is recommended.

The use of old litter for baby chicks is not recommended due to disease and parasite exposure and possible harm caused by ammonia fumes.

Brooder Guard

The brooder guard eliminates floor drafts and confines chicks to the heated areas. Corrugated eighteen-inch cardboard or any draft proof material may be used. When chicks are started in hot weather the guard may consist of fine mesh wire. This guard should be placed two feet away from hover edge, with waterers and feeders inside. Gradually increase size of confined area as conditions warrant. Remove the guard entirely when chicks are one or two weeks old, depending on weather conditions.

Waterers

Supply one gallon-sized waterer for each 100 chicks. Place the waterers



A gutter-pipe waterer supplies ample drinking space

about a foot from the hover but inside the brooder guard. At the end of two weeks the small waterers can be replaced by large fountains, or, if the brooder house is equipped with running water, the chicks can be trained to use the automatic waterers. It is advantageous to have the chicks use the automatic waterers as soon as possible. After larger water units are introduced it is necessary to continue the use of the smaller units and gradually move them toward the larger or central automatic waterers and leave them there for a few days. If this is not done chicks may not learn to drink from the new source of water, resulting in unevenness in growth and excessive mortality.

Hoppers

The following table may be used as a guide for feeding space requirements per 1000 chicks:

Chick size feeders (up to 2 weeks)	— Sixteen 30 inch feeders.
Intermediate size (2 to 8 weeks)	— Sixteen 4 foot hoppers.
Large size (after 8 weeks)	— Sixteen 5 foot hoppers.
Mechanical feeder space (up to 10 weeks)	70 feet of trough.

Lights

Lights should be placed in the brooder house so that the chicks can see to bed down at night. These lights, $7\frac{1}{2}$ or 10 watt bulbs, should not be bright enough to allow chicks to eat at night.

When a hot water brooder system is used place $7\frac{1}{2}$ watt bulbs every six or eight feet under the hover.

Chicks per Unit

Do not over-crowd. Approximately 300 chicks to the individual stove is enough, regardless of floor space. In large brooding installations such as hot water or hot air systems, allow one half square foot of floor space per chick up to 6 weeks of age, one square foot per chick to 12 weeks, one and one half square feet to 16 weeks, and two square feet to twenty weeks.

Temperature

A strong healthy chick may easily be ruined by either chilling or over-heating. Therefore proper regulation of the brooder temperature is very

important. For the first week the temperature should be 90° F. at the edge of the hover about two inches above the litter. Reduce heat about 5° F. per week, unless there is a disease present, such as coccidiosis or a respiratory outbreak, in which case a slightly higher temperature than normal is beneficial.



The thermostat should be located near the hover but out of reach of the chicks

Room temperature with space heaters should be 88° F. at fifteen inches above the floor for three days, then dropped 5° F. per week, depending on weather conditions, until a 70° F. heat level is reached. The action of the chicks is a guide to proper heat. If too low the chicks crowd, and if too high they will stay around the outside edge of the pen. Drafts cause them to crowd in a sheltered spot. When

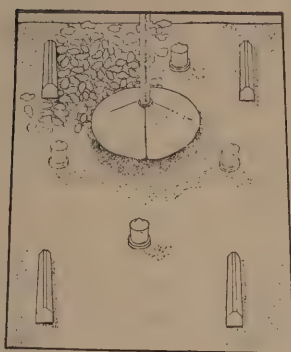
the proper temperature is maintained the chicks will be active and use the entire space allotted them.

At night they will form a complete circle around the outside of the hover, except when gas or electric brooders and certain types of hot water or hot-air brooders are used, in which case the chicks will be evenly distributed over the heated area.

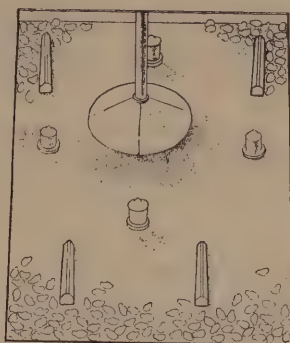
Harden-off the chicks before they are moved to new quarters where no heat is furnished. This is done by gradually lowering the temperature until no heat is used.

Ventilation

Fresh air is very necessary for chicks even when it is cold outside. It is

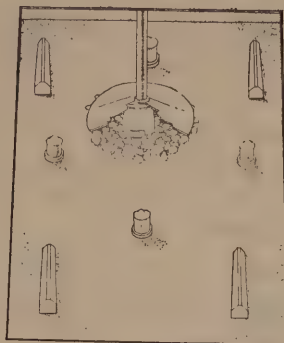


Drafty



FAULTY MANAGEMENT

Too hot



Too cold

easier to heat dry fresh air than it is to heat damp stale air. Proper ventilation may be had by the use of windows alone by opening the center windows first and then those on either side of the center windows as more air is needed. Drafts are generally eliminated by this method. Sometimes exhaust fans are necessary to aid ventilation of the brooder house.

Severe damage may occur from Kerato-conjunctivitis (blindness) caused by strong ammonia fumes from litter in poorly ventilated houses. See chapter, **POULTRY HEALTH**.

Humidity

The health and comfort of the chicks may be helped by proper humidity in the brooder house. Dusty litter may indicate very low humidity. In



Window method of ventilating pens. Open center window first to avoid drafts

extreme cases even dehydration of the chicks may result. In such a case sprinkle water (a garden sprinkling can is good) on the litter under the hover to improve the condition. Generally by the time the chicks are two weeks old moisture from the droppings supplies enough humidity. When hot air brooding is used moisture may be added at the source of the heat.

Roosts

Roosts are not necessary during the brooding period. When roosts are used in the laying house they may be used during the starting period.

Feeding Program

During the brooding period poultrymen may feed their replacement chicks either Wirthmore Complete Chick Starter or Wirthmore Improved Hi-Ener-G Starter and Broiler Ration. With both rations the feeding program is the same. Both feeds are available with or without medication for Coccidiosis prevention and can be bought in both mash and intermediate pellet form.

Feeding Directions

Keep the mash before the chicks at all times. Some poultrymen use egg flats or papers the first few days. Chick boxes cut down to 1 1/2" sides work very well for the first 2 to 3 weeks. Where hoppers are used fill them liberally for the first few days. Reduce the level of feed in the hoppers gradually to prevent waste as the chicks grow older. It is advisable to



The "line-up" at meal time with a mechanical feeder. Note space heater in background

feed at least twice daily to insure having fresh feed before the birds at all times, to minimize waste and to give less opportunity for them to eat contaminated feed from the litter.

At 2 weeks of age begin to feed the same ration in pellet form on top of the mash in the hopper. Feed the pellets once daily either at noon or in the late afternoon in amounts that will be eaten in 20–30 minutes. This will normally result in one bag of pellets being consumed to each four bags of mash.

The pullets' feed may be changed at 8 weeks of age to Wirthmore Growing Mash and scratch grain, or at 10 weeks to Wirthmore Complete Growing Ration or Wirthmore Hi-Ener-G Grower. Cockerels in replacement flocks which have been started on Wirthmore Complete Chick Starter may be grown to broiler weights on that feed with entirely satisfactory results. Otherwise, they may be fed as recommended for broilers or roasters, after separation from the pullets. See chapter, **POULTRY MEAT**.

Coccidiosis Prevention

Coccidiosis in chickens is the rule rather than the exception. The infection may or may not be serious and the economic losses from it may be large or small, varying with circumstances beyond control as well as with management. Experienced poultrymen, however, consider coccidiosis a constant and major hazard in raising chickens and take precautions to avoid damaging attacks. Many poultrymen now find the recently developed drugs to be their most effective protection.

A real advantage for these drugs is their preventive action when given continuously in a small amount mixed in feed. At a higher level they are also useful for treating an outbreak. Properly medicated feed mixtures when used as intended have shown unquestionable value in these respects.

For this reason, Wirthmore rations for starting chicks can be obtained suitably medicated with a reliable drug as an aid in coccidiosis prevention. A mixture for use in outbreaks is also available. Directions are printed on the back of all medicated feed tags. For further information on coccidiosis see chapter, **POULTRY HEALTH**.

Good Management Aids

An ample supply of clean water is essential at all times. Chickens need a quart of water for each pound of feed they eat.

Grit helps birds get more out of their ration. Scatter granite or mica grit on the mash the 3rd and 4th days — a small handful for each 500 chicks. After the first week keep grit before the flock in a hopper.

Spilled feed reduces feed efficiency and increases the chances for litter-

borne infections. Cut down spillage by providing liberal hopper space, by only half-filling the hoppers and by feeding 2 or 3 times daily only as much as will be almost cleaned up by the next feeding time. Don't let chickens go any length of time without some feed before them, for the first few weeks. Empty hoppers lead to litter picking and other bad habits.

Chick Management "Do's"

1. Plan chick purchases well in advance of your needs.
2. Take time off and visit those from whom you would like to purchase chicks.
3. Buy only from a pullorum-clean source.
4. Operate heating units at least two days before chicks arrive.
5. Have litter, guard, feed and waterers in place before putting down chicks.
6. Reduce both hover and room temperatures as rapidly as possible and still have the chickens comfortable.
7. Sprinkle the litter with water the first two weeks if necessary to provide sufficient humidity.
8. Feed two or three times a day and let hoppers get empty once a day.
9. Use a deep litter.
10. Provide one gallon-size water fountain for each 100 chicks.
11. Feed chickens the first two or three days on paper plates or flats in addition to hoppers. Then provide enough hoppers so that all chicks can eat at one time.
12. Provide small light bulbs ($7\frac{1}{2}$ watt) under hot water hovers.
13. Avoid floor drafts.

Chick Management "Don'ts"

1. Don't let price be the dominating factor in your chick purchases.



Hot water system with home made hover insulated with shavings.
Insert shows piping beneath hover



2. Don't expect to get chicks from good sources without giving an order well in advance of your needs.
3. Don't put chicks in dusty, poorly-ventilated brooding units.
4. Don't overcrowd.
5. Don't make a hothouse product of your chicks with too high temperatures.
6. Don't fill hoppers so full chicks will waste feed.
7. Don't keep guard too close to brooder unit. Don't use it too long. Two weeks is enough.
8. Don't let wet, caked litter accumulate on the floor.
9. Don't use lights that are large enough to permit chicks to feed at night.
10. Don't let chicks bed down in the corners of the brooding unit.
11. Don't poison your chicks with coal tar fumes.
12. Don't brood two ages of chicks together.
13. Don't change too abruptly from water fountains to one central water unit.



Arrangement for storage feeders

The Growing Period

THE subject matter in this chapter deals with replacement birds through the growing period. It is important that birds have a good start. At the end of the starting period the birds should be adjusted to conditions suited for the rearing of healthy, vigorous, mature pullets.

There is a tendency for poultrymen to fail to recognize the ability of young birds to adjust themselves quickly to growing conditions. Winter and early spring brooding often present the problem of holding birds under too high temperatures and in overcrowded quarters much longer than is good for growing pullets. Late spring and early summer hatched pullets should be placed either on range at the earliest possible date or given ample floor space if they are to be reared in confinement. Careful practices during the growing period will go a long way toward producing quality pullets.

A wide variation in rearing practices is necessary due to the many factors that must be taken into consideration, such as:

1. Physical aspects of each farm including contour of the land, drainage, type of soil, location and amount of land available.
2. Facilities available in the form of range housing or large houses suitable for confinement rearing.
3. Personal preferences of the operator.
4. Farm labor available.

Successful Pullet Growing

The essentials of sound management necessary to successful pullet growing include: (1) Proper sanitation, (2) Ample space per bird, (3) Satisfactory feeding program.

There are three systems, with variations within each, employed in growing birds. They are: (1) Range, (2) Total confinement, (3) Semi-confinement.

Each of the above mentioned systems has advantages and disadvantages which should be considered before the poultryman makes his selection.



Growing birds on well-sodded orchard range

Range

A good range, properly managed, furnishes an ideal environment for the growing of replacement pullets.

Size and Topography

A well-sodded range with gentle slope, preferably southern, is desirable. Sloping land contributes toward good drainage. Insufficient land or poor range conditions would make it wise to consider confinement or semi-confinement rearing. It is recommended that between 500 and 600 birds be the limit for an acre of good range.

Soil

Medium heavy loam that will support good sod and allow for good drainage is most desirable. Heavy soil with poor drainage which could create conditions favorable for diseases and parasites should be avoided. Light sandy soil is used quite successfully in many areas. It is cleaned easily by rain. It will permit little or no cropping except for an early crop of rye or similar plants which will mature before hot weather.

Vegetation

Quality pullets can be raised economically on a good range. An ideal range should provide adequate succulent green feed and ample area for the growing flock.

In practically all sections of the United States, particularly the Northeast, Ladino Clover is ideal for a poultry range. Ladino grows very rapidly

and provides succulent green feed during the entire season. It is palatable and has a high protein content.

Seeding recommendations vary in the different sections of the country. Therefore, contact the local county agricultural agent or poultry service representative for recommendations.

Meadow mixtures, such as Ladino Clover, Alfalfa, Red Clover, Timothy, or Brome Grass, also make satisfactory ranges for poultry. Blue Grass and White Clover sods, which have been limed, fertilized, and pastured or clipped to keep them tender and succulent, make good spring and fall range. They cannot be depended on during drouth conditions.

Some suggested mixtures include the following:

- a. 5 lbs. Red Clover
1 lb. Alsike Clover (on moist soils)
3 lbs. Timothy
2 lbs. Ladino

Seed this mixture at the rate of 12-15 lbs. to the acre. The other clovers serve to provide a cover while the Ladino is getting started. The Timothy is used to insure against a crop failure.

- b. 12 lbs. Kentucky Blue Grass
2 lbs. Ladino Clover

Seed 14 lbs. to the acre.

- c. 5 lbs. Timothy
6 lbs. Red Clover
3 lbs. Alsike Clover
5 lbs. Kentucky Blue Grass
2 lbs. Ladino Clover

Seed 21 lbs. to the acre.

- d. If no clovers are desired, a mixture of 15 lbs. Kentucky Blue Grass and 10 lbs. of Timothy per acre may be used.

A temporary range should be considered where a permanent one is not possible. Winter wheat or rye seeded in the fall at the rate of three to four bushels per acre provides a good early range. The forage should be eaten or clipped so that it will remain succulent and continue to grow over a longer period.

Range Housing

Most of the range-grown birds are housed either in range shelters or colony brooder houses. Housing for growing stock should afford protection from weather extremes and predatory animals. Individual range shelters are most commonly used for range housing. Although they may vary somewhat in design, basically they serve the same purpose.

A shelter with even span or shed type roof accommodating 125-250 pul-



Range views showing various types of range shelters

lets is commonly used. To insure a thorough coverage by the flock they should be distributed over a large area. Where strong winds prevail they should be anchored.

Shelters should be built on substantial skids so that they can be easily moved.

It is advisable to place roosts one foot apart on 1" x 2" heavy gauge wire floors or 1" x 2" wood-slat floors allowing 6 linear inches of roosting space per bird.

A one-story combination growing and laying shelter which will accommodate relatively large numbers of birds is becoming popular. This type building is both convenient and adaptable to efficient management. It should be located so that birds may have access to permanent range on either side of the building. Wider range coverage may be obtained by periodically moving the feeders further away from the house.

This type of building can be built at a relatively low cost. Some of the advantages of such a building are: 1. It saves labor. 2. It is adapted for growing and laying stock. 3. It may be used for a brooder house. 4. Better protection from predatory animals. 5. More convenient to care for birds during adverse weather conditions.

The combination shelter has a particular advantage where early hatched pullets are concerned. With these birds it is desirable to have them concentrated in large units where it is practical to maintain a



Growing birds may be ranged early in protected range shelter of this type

constant water supply and adequate feeding facilities. In case of extremely cold weather, heat may be provided to assure comfortable quarters for young birds.

Water

A plentiful supply of water is an invaluable asset to any poultry farm. The supply can come from a well or a spring. Ponds and streams are also satisfactory sources if the water is free of contamination. Where the range is close by, water can be piped to it.

This not only saves a great deal of labor but keeps fresh water before the pullets at all times. Some have permanent pipes which can be drained in winter. Others lay a temporary pipe from the water supply. The line can be protected by opening a furrow, putting in the pipe and then filling over it. Others use a barrel or water tank wagon with a hose running to water founts which are equipped with float controls. It is estimated that up to 75 gallons of water are necessary for each 1,000 birds. A good disease precaution is to



Range waterer on wire platform

place drinking equipment on wood slat or wire platforms to keep birds from damp droppings.

Provide Shade

Natural shade is desirable. A great deal of wooded farm area in the Northeast has been turned into poultry ranges with good results. Shade furnished by trees of some height is preferred. It is advisable to trim out low hanging growth to expose the land to the rays of the sun and allow ample air circulation. Low, damp areas have a tendency to harbor disease and parasites and therefore should be avoided.

Transferring to Range

After the shelter has been cleaned and treated with mite repellent at least two weeks before it is used (preferably done the fall before) the wire sides and rear should be covered with either bags, burlap, sheathing paper, cardboard or even boards if the birds are to be placed in them during cold weather.



Shade helps to keep water cool on range

The removal of early-hatched pullets to the range is often delayed too long. There is a tendency to allow well-feathered healthy birds to stay in brooder houses when they should be in the shelters. The disease factor existing in the brooder house increases as the quarters become congested.

More birds are harmed in crowded brooding quarters than by cold weather in shelters.



Trailer and crates for transporting birds to range

The ability of well feathered six to eight weeks-old pullets to withstand cold weather is underrated. In many areas of the Northeast these birds may be ranged safely during the latter part of March. It is advisable to reduce the brooder house temperature as a hardening off practice prior to moving birds to range. When birds are first moved to shelters they should be confined in the shelter with feed and water for the first day or two so that they will learn to enter their own quarters at night. If bad weather occurs, this period may be extended. The bagging or other protective material should be removed as soon as the weather permits.

Feeding Equipment

Supplying sufficient hopper space to permit a majority of the birds to eat at one time makes it possible for the timid ones to get their share. It also

reduces the danger of feather pulling which may start as a result of the competition that occurs when fresh feed is placed in the hoppers. Feather pulling may lead to cannibalism, which may persist throughout the life of the flock.

As the birds grow, additional hoppers as well as larger hoppers should be supplied. The following is sufficient hopper space for pullets fed either the complete ration system or the scratch and mash system when scratch feed is hopper-fed:

Three 4-foot hoppers or their equivalent per 100 pullets until 12 weeks of age.

Four 4-foot hoppers or their equivalent per 100 pullets from 12 weeks of age to maturity.

Hoppers should be low enough to permit the birds to eat while standing on the ground. If scratch feed is fed on the ground the amount of hopper space may be reduced one-fourth to one-third.



Range feed bin (above) with iron braced skids for hauling about range. Closeup (below) shows interior of the bin which is designed for storage of scratch, pellets and mash

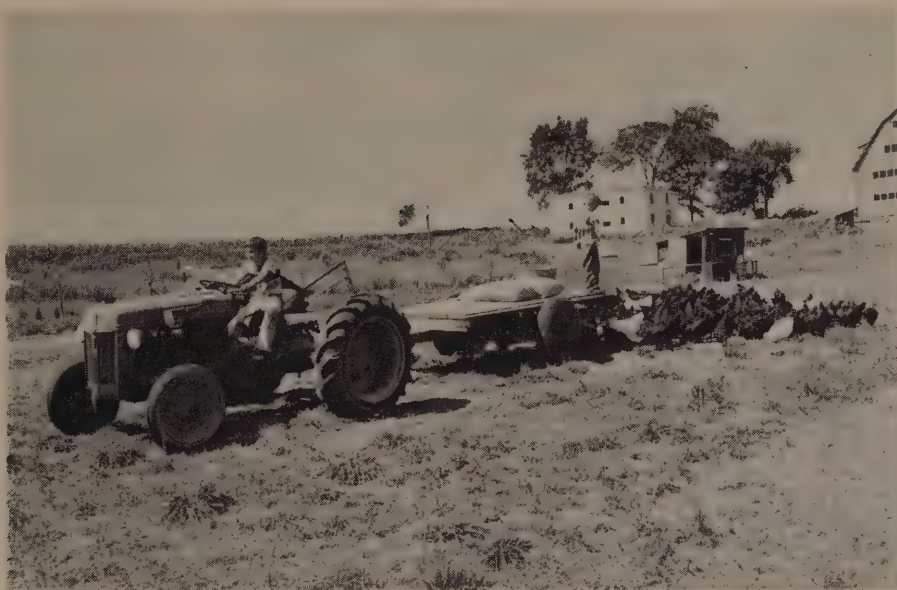
The capacity does not need to be greater than enough to hold one day's supply of feed. The clean-up system of feeding continues to grow in popularity. This system means that sufficient feed is placed in the hoppers so that the birds clean it up one or two hours before feeding time the next

day. Make sure the pullets are not out of feed too long. After a rain all moist feed should be eaten by the birds before fresh mash is added. When this is done, there is little danger of this moist mash staying in the hoppers long enough to get sour or mouldy.

Plans for feed hoppers may be obtained from Wirthmore Feeds, Malden 48, Mass.

Range hoppers should be moved once or twice a week to avoid killing the grass, and to prevent accumulation of filth.

Some poultrymen feed the entire ration supply in pellet form broadcast on the range. This practice means the elimination of range hoppers.



Trailer designed for hand feeding of scratch and pellets on range

When pellets or scratch grains are broadcast on range, a lime spreader or similar equipment is used satisfactorily. Some poultrymen release feed from back of moving truck.

Nests

Nests should be made available when pullets approach maturity. The same type and arrangement of nests as those to be used in the house should be used on range. This will help prevent floor laying when pullets are housed.



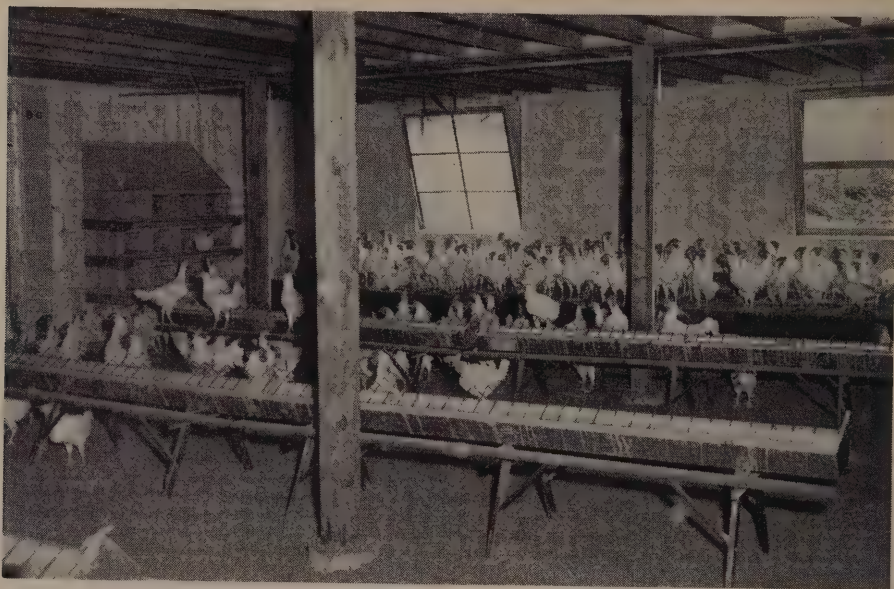
Range nest designed for easy moving

Confinement Rearing

Confinement rearing of replacement pullets has been on the increase during the last few years. In areas of high property value or acreage limitations it is economically practical to consider confinement rearing. There are several advantages:

1. Less loss from animals and thieving.
2. Better regulation of feed intake.
3. Elimination of housing shock prior to production period.
4. Saving in labor.
5. Elimination of ranging equipment.
6. Better chance to observe and cull birds.
7. Keeps laying house filled to capacity throughout the year.

There are two distinctly different types of confinement rearing: (1) floor rearing and (2) battery rearing.



Raised feeders may be used with confinement grown White Leghorns

Floor Rearing in Confinement

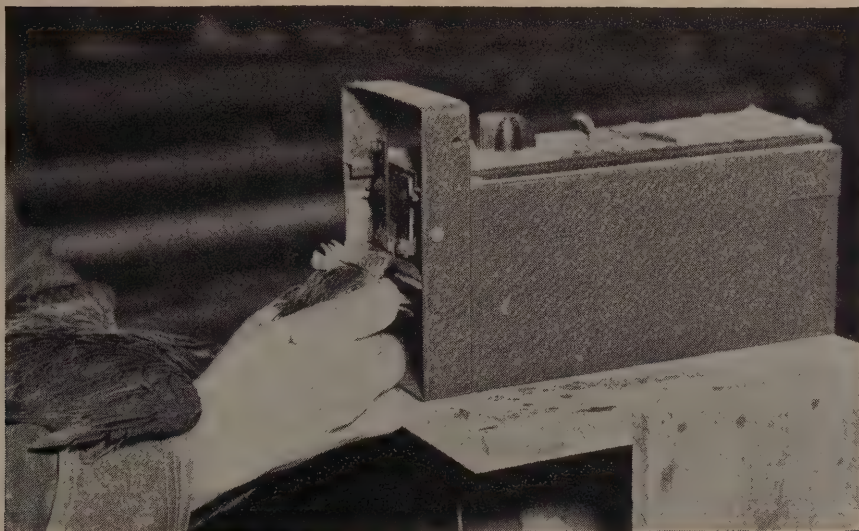
Pullets can be grown satisfactorily in any standard brooding or laying house. Management must conform to the demands of the growing birds. Following are some of the factors which should be considered:

1. Ample space: Floor space needed per bird depends on the size of the pens used. In small pens which are less than 24' x 24' at least three square feet should be allowed per bird. As the pen size increases less space per bird is needed. Many poultrymen are allowing as little as two square feet per bird in large pens.
2. Provide good ventilation: Growing pullets are probably more sensitive to lack of good ventilation than laying hens. While sensitive to drafts, adequate access to fresh clean air is necessary for proper development.



Growing birds reared in confinement

3. Hopper space must increase as the birds grow. Sufficient feeder space should be provided so that the majority of birds can eat at one time.
4. Size of hoppers should be increased as the birds grow. Use broiler size hoppers until 12 weeks of age and then change to hen size hoppers.
5. Waterers should never become empty except when cleaned. Automatic waterers or constant flow systems are recommended.
6. The feeding of birds grown in confinement is of even more importance than when birds are grown on a good range. The feeding of the complete or all mash ration is recommended as it is then impossible for the birds to unbalance their diet. If the



De-billing confinement reared birds

mash and scratch system is used it is recommended that the proportions be kept to what is known as the 50-50 ratio; in other words, equal parts by weight of mash and scratch. At no time during the growing period should the proportion of scratch feed exceed 60% of the total feed intake for even a short time. Pellets may be used as a supplement in the feeding program. In confinement rearing it is not recommended that pellets replace mash entirely.

Battery Rearing

When the pullets are to be kept in laying cages after maturity they may be battery grown. When such a program is used it is well to follow the directions of the manufacturer of the particular equipment being used insofar as the age of the birds at time of transferring, and capacity of the cages are concerned. With some breeds or strains of birds it might be good management to grow fewer birds in a compartment than the manufacturer suggests. A few additional hints in respect to the management and feed of battery grown birds follow:

1. Room temperature should stay as near as possible within the 50° F. to 60° F. range. Start at 60° F. when the chicks are transferred from the starting to the growing battery and gradually reduce the temperature as the birds reach maturity. This reduction is possible only when birds of the same age are in one room.
2. Ventilation is a major problem. The air must be changed frequently, especially in hot weather, yet the birds should not be in a draft. The room should be fully insulated. A ventilating shaft and an electric fan will force the movement of air when necessary.
3. A relative humidity of 60% is considered about right for birds under battery conditions. There is little likelihood of it going too high. When it gets too low, water may be sprinkled on the floor or, better still, it may be controlled by the use of a thermostatically controlled humidifier.
4. Reduce the number of birds per compartment as they increase in size. This may be done by using more sections of growing batteries or by transferring them directly to empty laying cages. Pullets from 12 to 16 weeks of age, when they are transferred to laying



Pullet before de-billing



Pullet after being de-billed

cages, may be doubled up by putting two to a laying cage. As they approach maturity they should be separated.

5. Birds grown in confinement are likely to be frightened easily and therefore should not be kept in too brightly lighted quarters. Light enough for them to see to eat and drink is all that is necessary. It is doubtful if artificial lights are desirable except on very dark days, when natural lighting is poor. Too much light, either natural or artificial, in the growing room may be a factor in the starting of feather pulling that leads to cannibalism. The use of red paint or enamel on electric light bulbs, or on the inside of the growing room windows will assist in controlling such outbreaks.

Semi-Confinement Rearing

This system is suggested for poultrymen with limited range adjacent to the house. Such ranges should be cultivated and seeded to some fast growing annual or covered with sand or gravel. When either sand or fine gravel is used it should be replaced or renewed for each brood for sanitation purposes. The yards may be divided so that planted areas can be rotated during the growing season.

Poultrymen following this system often use single-story houses in which the chicks are brooded and reared, allowing the birds to use the limited range facilities as soon as they are old enough and weather permits. Feeding and watering facilities should be available in the yards as well as in the house. The size of the range used depends on the plant setup. It is generally impractical to attempt to maintain permanent grass under these circumstances. One objection to this manner of rearing is the diffi-



Combination range and laying shelter which may also be used for brooding

culty in maintaining proper sanitary conditions. The practice of maintaining deep litter in the growing quarters should be followed. Frequent addition of fresh sand or gravel in the immediate vicinity of the entrances will help maintain sanitary conditions.

Vaccination and Inoculation Program

Disease control is a very important management problem during the growing period. Vaccination or inoculation for disease which can be controlled by this program is inexpensive insurance against interruption of production during the laying period.

Serious outbreaks of the following diseases can usually be prevented by following an approved disease control program (see chapter, **POULTRY HEALTH**):

1. Fowl Pox
2. Newcastle Disease
3. Infectious Bronchitis
4. Laryngotracheitis

In some states permits are necessary for purchasing live virus and it is always advisable to consult the office in charge of state regulations regarding this program.

Precautions Regarding Disease Control Program

1. In general, birds that are out of condition should not be vaccinated or inoculated until they return to normal health.
2. In cold weather young birds should be given extra heat while recovering from inoculation or vaccination.
3. In order to help avoid outbreaks of coccidiosis during the period immediately following vaccination or inoculation, it is recommended that a coccidiostat be used.
4. Use proper equipment for catching, and temporarily holding the birds during the routine of vaccinating.
5. The birds should be confined in a large enough area to allow the poultryman to work among them without having them pile up and smother.
6. Catching frames which are built in sections and connected by hinges can be used to facilitate the handling of pullets in large pens.
7. It is advisable to hire extra help to speed up the job, prevent smothering, and to avoid the necessity of holding birds in close confinement for too long a time.
8. Birds should not be disturbed in extremely hot periods unless done in early morning while air is relatively cool.

Protecting the Flock

Thieves and varmints are a menace which may strike at any time and all reasonable precautions should be taken to prevent loss from these sources.

Tattooing was once considered a good protection from thieves, but the labor involved has caused most poultrymen to seek other means of protection. A sound pickup system is effective and inexpensive. A good watch



An electric fence is effective against prowling animals



dog is a valuable asset to any range. Also flood lights covering the range area are very effective. When the flock is large enough to warrant the

expense of a watchman, one could well be employed.

Some poultrymen use an electric fence eight inches above the ground and eight inches outside the range fence to keep out foxes and stray dogs.

Use varmint proof range shelters that can be closed at night.

Grading Pullets

When pullets are put out on range they should be graded so that birds of uniform size are kept together. The older and more vigorous birds tend to drive the smaller ones from the feeders and waterers and prevent them from getting the proper amount of food and water for normal development.

Retarded birds when segregated



Grading confinement grown pullets

from the rest of the flock will generally develop into normal and profitable layers if given a little extra care.

Culling

Pullets should be culled thoroughly when put on range and any questionable ones should be sold. Range mortality, feed and other expense will be reduced by proper culling at this time. A continuous culling program is recommended throughout the growing period.

Housing Pullets

Generally when pullets reach 10% production they should be moved to their permanent laying quarters. Early pullets can be left on range during hot weather if proper nesting facilities are made available.

Late pullets should be housed, under most conditions in the northeast, not later than November 1st.

Feeding Growing Stock

Two common systems of feeding are employed for growing birds — the complete ration system and the mash and scratch system. Both are effective and practical. When either system is used the entire mash supply may be fed in pellet form if the birds are range reared. There are five good reasons why pellet feeding can replace the mash in your range feeding program.

1. Pellet feeding provides for more efficient use of feed.
2. Helps prevent loss of feed by wind and spillage.
3. Saves labor.
4. Encourages feed consumption, especially during periods of extreme weather conditions.
5. Helps maintain good sanitary conditions around feed hoppers.



A mechanized method of spreading pellets or scratch on range

Whether scratch and mash or a complete ration are fed it is important to provide enough feeder space so that a majority of the birds may eat at the same time. Whether birds are grown on range or in confinement, keep a supply of granite or mica grit before the pullets at all times. When pullets "redden up" or "comb up" and show signs of coming into production, they should be supplied with oyster shells and hard grit or, if preferred, limestone grit alone. An adequate water supply should be available at all times.

Wirthmore Poultry Fitting is a molasses sweetened feed, which may be fed to growing stock as an appetizer or conditioner when abnormal circumstances indicate its need. It should be fed in amounts that will be cleaned up in twenty minutes.

Changing Growing Birds to the Complete Ration System

It is practical to change from the scratch and mash system of feeding to the complete ration system at any time during the growing period up to the time that production reaches 10%. To do this, change the mash more or less abruptly but take a few days to discontinue the scratch feed. Pellets in small amounts may be substituted for the scratch feed as the scratch is discontinued, feeding them at the same time of day. If the growing mash is being fed in pellet form it will be merely a matter of changing to complete growing pellets and discontinuing the scratch feed.

Wirthmore Complete Growing Ration

Wirthmore Complete Growing Ration is designed to furnish all of the known nutrients required by the growing bird. It should be fed from the end of the brooding period until pullets are laying 10% or are old enough to lay. At this time the birds should be fed Wirthmore Complete Egg Ration for market egg production or Wirthmore Complete Breeder Ration for the production of hatching eggs. It should be fed to cockerels, kept for breeders, as well as to pullets.

Complete Growing Ration comes in both mash and pellet form, and is intended for growing birds both on range and in confinement. As the name implies, *no scratch grain should be fed* with Complete Growing Ration.

Feeding Growing Birds on Range. There are three methods for feeding Complete Growing Ration: (1) all-pellet feeding; (2) mash and pellet feeding; (3) all-mash feeding. The one the poultryman selects depends largely on individual circumstances.

The all-pellet method of feeding growing pullets is accepted as a good practice where satisfactory range conditions prevail. Allow a few days to teach the birds to eat pellets, if pellets have not been fed previously.



A method of moving and storing feed on range

Pellets may be fed in any one of the following three ways: (1) In large self-feeding waterproof hoppers that will hold several days' supply of feed. (2) Scattered on the ground twice or more daily in amounts that will be cleaned up in 20 to 30 minutes. (3) Hopper fed once daily in amounts the birds will clean up before the next feeding.

With the mash and pellet method Complete Growing Ration should be available in mash form at all times except to allow the hoppers to become



Automatic feed hopper and trough used in feeding growing birds in confinement

empty once a day. This helps stimulate appetite. In addition to the mash, feed Wirthmore Complete Growing Ration pellets once a day in amounts that will be cleaned up in 20 minutes.

With the all-mash method keep Complete Growing Ration in hoppers at all times except to allow the hoppers to become empty once a day.

Feeding Growing Birds in Confinement. Feed Wirthmore Complete Growing Ration in mash form throughout the growing period. It may be fed manually by conventional methods or in mechanical feeders. A supplementary feeding of pellets in amounts up to one-third of total feed intake is also recommended. However, the practice of feeding a greater proportion of pellets in confinement may lead to feather pulling.

The complete ration system is especially appropriate for use with a mechanical feeder. Experience shows that the use of pellets as a supplement to mash is not necessary when feeding is done mechanically.

Wirthmore Hi-Ener-G Grower

Wirthmore Hi-Ener-G Grower is available for poultrymen who prefer a low fiber, high efficiency type growing ration. Hi-Ener-G Grower is a complete feed available in both mash and pellet form, and is fed in the same manner as Wirthmore Complete Growing Ration.

Wirthmore Growing Mash

Wirthmore Growing Mash should always be fed in conjunction with scratch grains. It should be fed from the time chickens are changed from a starting ration until they are laying 10% or are old enough to lay. At this time birds should be changed to Wirthmore Laying Mash for market egg production or Wirthmore Breeder Mash for hatching egg production.

Growing Mash contains all the nutrients necessary to balance heavy hard grain feeding. Therefore, during the latter part of the growing period Wirthmore Scratch Feed, hard grains, or any combination of hard grains may be fed up to 70% of total feed intake.

Feeding on Range. Growing birds on range may be fed either Growing Mash and scratch or Growing Pellets and scratch. When the pellet method is chosen good range conditions should prevail. Any one of three pellet feeding techniques is recommended when the pellet and scratch method is followed: (1) Use large self-feeding waterproof hoppers that will hold several days' supply of feed. (2) Scatter on the ground a daily or twice daily feeding of pellets in amounts that will be cleaned up in 15 to 20 minutes. (3) Hopper feed once daily in amounts the birds will clean up between feedings.

With the mash and scratch feeding method one of two mash feeding techniques may be employed: (1) Use large self-feeding waterproof hop-

pers that will hold several days' supply of feed. (2) Hopper feed once daily in amounts the birds will clean up between feedings.

With both the mash feeding method and pellet feeding method scratch grains may be fed in either of two ways: (1) Feed on the ground either by hand or from a moving vehicle all that will be cleaned up before dark. (2) Feed several days' supply in covered hoppers.

Scratch grains may be increased gradually up to the point where they constitute 70% of total feed intake during the later stages of the growing period.

Feeding in Confinement. Wirthmore Growing Mash should be available at all times except to allow the birds to clean up feed once a day.



Interior of combination range and laying shelter showing nests

It may be fed manually by conventional methods or in mechanical feeders. Scratch grain consumption can be gradually increased until the birds are eating equal parts of scratch and mash. Even larger proportions of scratch may be fed as birds approach maturity. Many feeders rearing pullets in confinement use considerable amounts of oats as part of the scratch feeding. Scratch should be hand fed.

Feeding Pullets Confined to Batteries

The feeding method most commonly used and best adapted to birds grown in batteries is the complete ration system. Begin feeding Wirthmore Complete Growing Ration when the pullets are eight to ten weeks of age and continue until production starts, or has reached 10%.

Wirthmore Complete Growing Pellets may be fed in combination with Wirthmore Complete Growing Ration when, for any reason, it is necessary

to improve the condition of the pullet flock during the growing period. This is especially true the last month before egg production begins. As a rule, after body weight is satisfactory, pellet feeding should be gradually discontinued so that it may be used again later on when needed.

There are two methods of feeding, either of which may be followed. One is to keep the feed hoppers well filled with Wirthmore Complete Growing Ration except to permit the birds to nearly empty them two or three times each week. The other method is to feed the ration in amounts that will be eaten before the next feeding period. The latter method has a tendency to produce keener appetites. A small amount of intermediate-size hard grit (mica or granite) should be scattered on top of the mash once each week. No oyster shells or other calcium material should be given until approach of maturity. Begin feeding oyster shells and hard grit, or calcite grit alone, at that time.



A large combination range and laying shelter

Range Management "Do's"

1. House all pullets before November 1st.
2. Provide enough hopper space so that all birds may eat at one time.
3. Provide suitable shade.
4. Keep grass mowed.
5. Utilize range to best advantage by moving hoppers frequently.
6. Cull thoroughly when birds are placed on range.
7. Train birds to their shelters.
8. Have plenty of fresh water available at all times.
9. Allow at least six inches of roosting space per pullet in shelters where roosts are used.
10. Start enough birds to allow for rigid culling.
11. Provide suitable nests two or three weeks before pullets start laying on range.
12. Be alert to symptoms of coccidiosis in growing birds.
13. Control outbreaks of intestinal coccidiosis by using a Wirthmore medicated mash.
14. After pullets are housed, prepare shelters for next year. Clean, disinfect and apply mite repellent in the fall.

15. Grow grass on the range if possible. It pays.
16. Protect against thieves; after the birds are stolen it's too late.
17. Pullets are tougher than you think. Get them out early.
18. Which do you like better, cold or tepid water? So do your pullets.

Range Management "Don'ts"

1. Don't locate shelters on low areas.
2. Don't leave birds shut in shelters more than two hours after daybreak.
3. Don't rely on lime to purify the soil.
4. Don't burn ranges — mow the grass in the fall.
5. Don't overcrowd shelters.
6. Don't overcrowd ranges.
7. Don't run different ages of birds on same range.
8. Don't leave shelters bagged up after birds are hardened to range conditions.
9. Don't let pullets drink stagnant water from holes on range. Fill in the holes.
10. Don't use mortality as a guide in determining success in raising good pullets.
11. Don't take chances. Vaccinate if you should.



Range with high shade. White shelter roofs reflect hot sun

The Laying Flock

MANY major changes have taken place in the last few years in the housing and management of laying flocks. The changes include improved housing conditions, the use of many labor-saving devices and new ideas in the use of various kinds of laying house equipment. These changes have helped improve working conditions on the poultry plant and have aided in reducing the tedious daily chores. At the same time they have helped increase profits to poultrymen.

Probably the greatest factor is the change in the number of laying birds kept in one unit. Only a few years ago it was common practice to have



Modern hen house with relatively small number of windows

units of 100 to 150 layers. Now many poultrymen are housing their layers in units of a thousand and more with good results.

Wirthmore has kept pace with the ever-changing conditions and has available laying-house plans to take care of almost any size unit in which

poultrymen may be interested. These plans can be had without cost by writing to Wirthmore Feeds, Malden 48, Massachusetts.

Commercial Laying House

The climate in most of the Northeast is such that substantial laying house construction is desirable. In the long run the house should provide comfortable quarters for laying birds during extreme temperatures of summer and winter.

In selecting the location for a commercial laying house, choose a site where there will be drainage away from the building. The front of the house may face any direction, but preferably it should face the south or the southeast. Easy access to the building should be provided for bringing in feed, litter and other supplies.

In making plans to build a laying unit, every phase of the construction expense must be considered. The cost of building laying houses is generally figured on a square foot basis. Since the foundation and roof represent more than one-half the total cost of the one-story building, laying houses more than one story high are more economical per square foot of floor space than one-story buildings. Electric hoists and elevators are available at reasonable cost. Such equipment will deliver birds, feed, litter and other heavy supplies to the second, third, and fourth floors of laying houses, reducing the cost of labor. They are operated at small expense.

Many modern features in poultry-house construction such as proper



Remodeled barn. Note roof windows to give extra light and ventilation

ventilation, hoists, etc., can be incorporated in old buildings, particularly barns. The effort expended in making plans for remodeling buildings of this type will generally result in a satisfactory laying house.

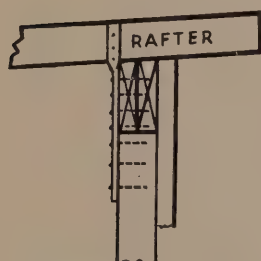
Floors

Usually a laying house should be constructed on a cement foundation. Cement is used for the first floor. It is a good plan to slope this floor toward a drain in the front wall at floor level. This will help in the job of cleaning the first floor with the use of water. The upper floors should be single board floors of narrow, matched material. Flooring must be perfectly dry when installed to prevent shrinking.

Roofs

Shed roofs, two-thirds span, and even-span roofs are the three styles generally used in the construction of laying houses. The shed roof is the cheapest construction, and if heavily studded and braced with an ample supply of posts will not suffer damage from heavy snow loads during the winter. Shed roofs should be covered with a so-called "built-up" or double lap roofing.

In the severe windstorms of recent years the weak places uncovered in poultry house construction were the sill fastenings on the foundation and the rafter fastenings on the plates and carrying beams. Strong sill fastenings and balloon type construction offer protection against winds of hurricane force. Balloon construction includes replacing the plates with ribbon boards and spiking the upper end of all studs on the sides of the rafters.



Carrying beam
with strap iron
Rafter 2x6
Carrying beam 2-2x6
Post 4x6
Tie beam 2x6

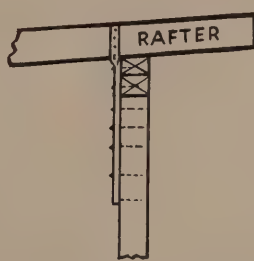
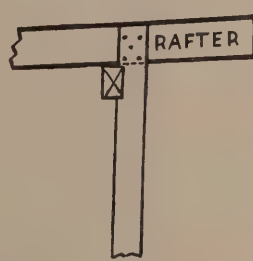
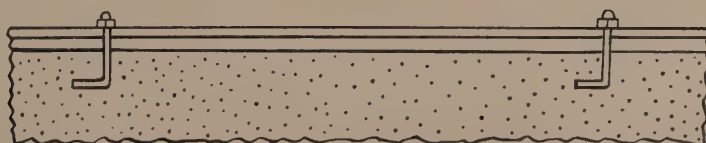


Plate reinforced
with strap iron
Rafter 2x4
Stud 2x4
Plate 2-2x4



Balloon construction
Rafter 2x6
Stud 2x4
Ribbon board 2x4



Sill with $\frac{5}{8}$ " tie bolts 8' apart set 8" in concrete foundation

Houses already constructed can be reinforced by spiking pieces of perforated strap iron or hanger rod on the side of each rafter, the plate and stud below, and also by tying the rafters to the carrying beam in the same manner.

Little can be done to correct poor sill fastenings in old houses, but new houses should have one $\frac{5}{8}$ " sill bolt set at least 8" in the foundation for each 8' of sill.

Windows

Windows are used in poultry houses to provide ventilation as well as light. Glass windows are the most common, but there are available so-called "glass substitutes" that are satisfactory. Windows in the front side of a laying house are the ones used for ventilation during the winter. Today most poultrymen are allowing 1 square foot of glass to about 25 square feet of floor space. These figures should be taken into consideration when framing the front of the house.

Usually windows are placed at the top of the elevation or directly under the plate. They slide down either on the inside or the outside of the building. If on the inside, drainage should be provided at the bottom of the window.

Insulation

Many kinds of insulation are available for use on either the inside or outside of exterior walls and ceilings. The purpose is to provide the laying flock with more comfortable quarters in both summer and winter.

In the shed-roof type of house, the insulation material can be nailed directly on the under side of the roof rafters. False ceilings in two-thirds and even-span houses should be included when either type of roof is used. The false ceilings may be constructed of insulating board, or matched lumber with insulating material placed on top of it. Louvres should be placed at both gable ends of the building above the false ceiling.

Areas which birds can reach should be covered with a type of insulating board that birds cannot damage by picking.

Two to four inches of air space between the outside and inside walls of the laying house will provide some insulation. Further insulation may be obtained by filling this space with dry shavings, sawdust, or other insulating products. If this is done, vapor barriers should be used on the outside of the inner wall to reduce condensation. If these insulating materials become damp, their insulating value is greatly reduced.

Fiberboard, with an asphalt and sand finish which is available in several colored brick or shingle designs, makes a satisfactory siding and at the same

time provides insulation. When insulation problems are involved, it is recommended that the poultryman seek the advice of the agricultural engineer at the state agricultural college or university.

Ventilation

Ventilation is important regardless of the size or shape of the laying-pen units. Restricted ventilation in modern poultry houses is based upon the fact that the moisture-carrying capacity of the air in these pens increases in direct relation to the temperature. Restricted ventilation controls the exchange of warm air in the house with the cooler air from outside. Warm moisture-laden air rises and will work to the highest point and flow in the direction of the least resistance.

In most of the Northeast, prevailing winds come from the northwest. This means that the flow of warm, moist air in a poultry house tends to go toward the south and east. Openings must be provided to allow part of this warm, moist air to escape and yet have these openings sufficiently restricted to permit recirculating the warmed air within the house in order to keep the litter dry during cold weather.

The circulation of air in laying pens can be regulated. It is important that good judgment be used in adjusting window openings. To prevent drafts,



To help prevent drafts, open center window the most, the one next to it a lesser amount, etc.

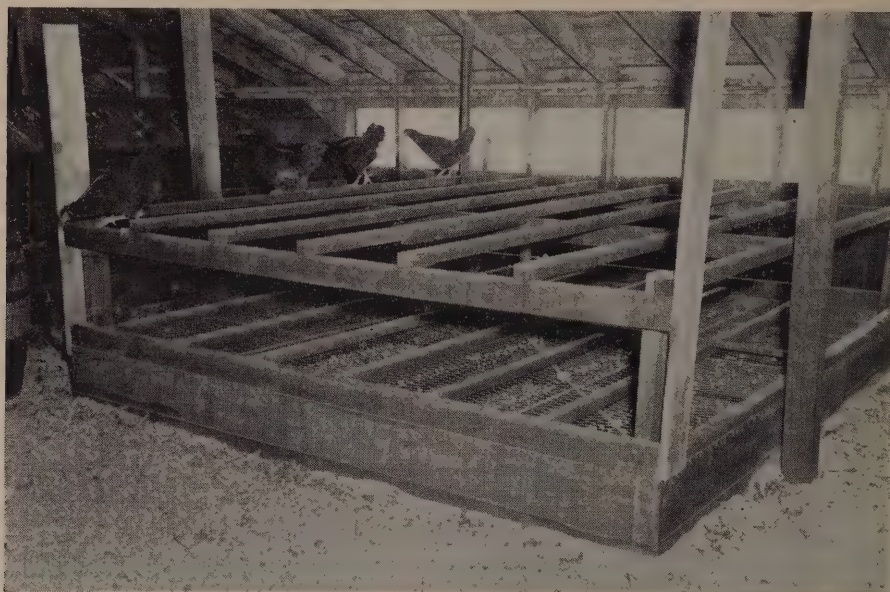
open the center windows in each pen more than the end windows. In extremely cold weather open only the center windows. This prevents cross drafts which are present when windows are open at both ends of a large pen.

There are instances where land contours and location of buildings are such that restricted ventilation is not practical. Flues, which project through the roof, have proved of definite help in solving some difficult ventilation problems. In other instances, the installation of fans has helped solve the problem of ventilation and wet litter.

Roosting Equipment

Roosting pits are a common and satisfactory method of providing a place for the birds to perch. The pit frames are approximately one foot high. On top of these are the roosting frames which bring the total distance from the floor to the top of the roost about 18 to 20 inches.

Multiple level roosting frames have been used successfully in large laying pens to reduce the floor area occupied by standard roosts and to increase labor efficiency. The frames are generally 5 x 10 feet and have either two or three roosting levels. They may be constructed so as to use the base as a dropping pit. The side boards of the pit should be 16 inches high and a 6 inch clearance should be allowed between the pit wire and the first level of roosts. "Two by three" or "two by four" material is used for uprights and roost supports. "Two by two" material is used for the roosts. The roosts are placed 18 inches apart on centers and the same distance is allowed between levels. If the roosts are placed directly above one another the droppings will clear the birds on the level below.



Two or three level roosting frames are practical space savers in larger pens

Roosting pits have several advantages over the older system of dropping boards. Droppings in the pits are allowed to accumulate over a period of one to three months. This eliminates the labor involved in the weekly



cleaning of dropping boards. Offensive odors and the breeding of flies can be reduced by spraying with DDT or Lindane and spreading superphosphate or hydrated lime from time to time over the droppings in the pit.

At the time of housing it is much easier to get pullets to roost on roosting pits than on the old-style roosts over dropping boards. The pits do not materially reduce the bird-holding capacity of the pen since roosting space is used constantly by a certain number of birds. At least six inches of roost space per bird should be provided for light breeds and seven inches for heavy breeds.

An objection to the pits is that they harbor rats in buildings that are not rat proofed. If this is a problem, the pits must be cleaned out more frequently in order to discourage rats. The use of the new rat poisons such as Warfarin are also effective. There is a tendency to eliminate pits from beneath roosts, allowing the droppings to mix with the litter. Some poultrymen are housing laying birds in pens where no roosts are provided.

Nests

One of the most effective labor-saving devices that has come into general use in laying pens is the community-type nest which is rapidly replacing the small individual nests. Community nests will accommodate approximately 5 birds per sq. ft. This nest is

Popular among poultrymen in different sections of the country are the various type nests shown in 4 illustrations at left

simple to construct. It provides more nesting space than the partition type and tends to reduce the piling-up habit of birds. It lessens egg breakage and cannibalism.

Wirthmore Construction Plans for nests may be secured from Wirthmore Feeds, Malden 48, Mass.

Feed Hoppers

These should be designed to make the feed readily accessible to laying birds and at the same time prevent feed waste. There are several types of metal and wooden hoppers that can be purchased. Plans for building wooden hoppers may be obtained from Wirthmore Feeds, Malden 48, Mass.

Three six-foot hoppers, or their equivalent, will supply ample feeding space for 100 birds. Labor can be saved in feeding by placing feed hoppers in a straight line. In deep pens where carriers are used a line of hoppers can be placed on both sides of the carrier track to help reduce the time required for the daily feeding chores.

Best feeding results in the laying pens, especially with heavy breeds, come from having all feed hoppers near enough to the floor so that the birds can eat while standing on the floor. In pens that accommodate large



A practical home made feeder

numbers of birds the mechanical feeder can be used to advantage. This mechanical equipment carries the feed from storage bins in or near a grain room through the laying pens in a continuous feed hopper.

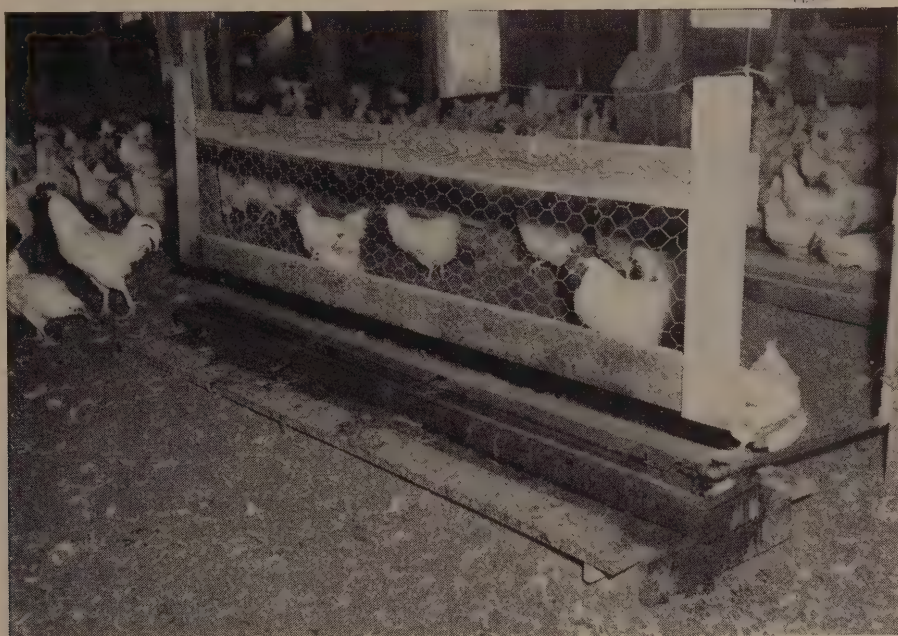
Water and Waterers

Water is essential in getting maximum results from any laying flock. An automatic water supply is recommended. The need for a constant supply of fresh water for poultry is easily illustrated by two facts:

1. Fifty-five percent of the layer's body is water.
2. Sixty-five percent of a fresh egg is water.

Without an adequate water supply, egg production is limited, feed utilization is poor, and the birds' health is injured.

Poultry, unlike most other farm stock, consumes only small quantities of water at a time. Therefore it is necessary to have a supply of water always



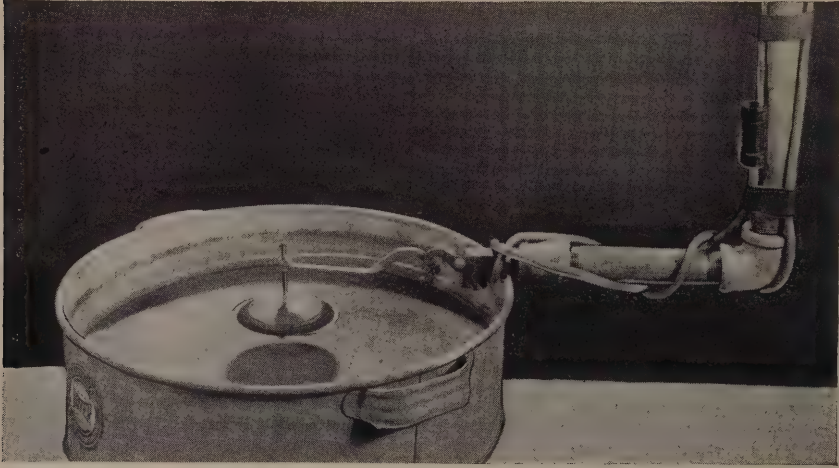
Trough type waterer for laying flock

available. A laying hen will consume approximately one quart of water to each pound of feed, totaling 170 lbs. of water during a laying year. The labor required to carry water reaches gigantic proportions. For example, a flock of 1000 layers requires approximately 21,000 gallons or 85 tons of water each year. Such quantities can be supplied economically only by an automatic system. There are available many types of equipment for furnishing satisfactory water supplies in laying pens.

A water unit must be constructed to minimize water spillage in order to keep the litter and the floor around the receptacles reasonably dry. There are several arrangements for supplying water and handling the overflow and spillage. None are fool-proof, and none perform 100% service in pre-

venting wet spots. Some methods of furnishing water require less drinking units than others and it is well to observe as many installations as possible before installing one's own. The trough type is desirable where large units of birds must be serviced. Regardless of the type of waterers used, good distribution within the pen is very important.

Soil heating cable or thermo-tape properly attached to the water system in its entire length, including all outlets will prevent damage from freez-



Thermostatically controlled heating cable or tape makes possible constant supply of running water in freezing weather

ing. It also helps provide laying birds with water from which the chill has been removed during cold weather. The initial cost is reasonable and installation can be made with a minimum of expense. The cost of operation when properly installed and thermostatically controlled is moderate.

Litter

The type of litter to use will depend upon its relative cost, availability and desirability. Shavings, straw, sawdust, ground corn cobs and sugar cane are used and as a rule are readily available in most areas.

"Deep litter" is an important factor in modern poultry keeping. "Deep litter" means an accumulation of at least eight inches of litter on the floor before cold weather or by the first of December in most of the northeast. The best way to handle new litter in a laying pen is to start with about three or four inches. As it is worked over and pulverized by the birds, add two inches of fresh material every three or four weeks. Follow this program until there is a total of eight inches on the floor.

If damp sawdust is used it should be put in during warm weather when it will dry out in the pens.

The practice of leaving some old litter in the laying pens is sometimes used. It saves the cost of new material, labor and cleaning. It provides better floor insulation and will stay drier than new litter during cold stormy weather. However, if parasitic infestations or certain disease problems are present, the use of old litter is not recommended. Where old litter is kept over in the laying pens, all damp and caked material should be removed and replaced with old litter from other parts of the pen. If necessary, new litter may be added at this time.

The use of hydrated lime has proved to be of value in keeping litter dry. Hydrated lime must be added to the litter during the early fall and get well mixed through the litter before cold weather. A good rule is to use one pound for each two to three square feet of floor space. More should be added as conditions demand.

Superphosphate at the rate of 25 lbs. per 400 square feet of floor space is also being used to help litter conditions and reduce excessive ammonia fumes in the pens.

Litter-stirring equipment is available. This equipment operates by electricity or by a gasoline engine and will do a satisfactory job of stirring the litter. This equipment will help to keep the litter dry and prevent caking.

Preparation of the Laying Quarters

There are still two schools of thought about preparing the laying house. One group advocates leaving the old litter year after year — the other group believes in the idea of cleaning the house thoroughly from top to bottom.

Even if the old litter is left, the ceiling, walls and floors of the pens should be thoroughly swept down. All the nests and roosts should be scraped and painted with carbolineum or some other good red mite repellent. Whitewashing the walls and ceilings will brighten up the pens and make them easier to clean next time.

If serious disease problems or infestations of red mites or other parasites



Mechanical litter stirrer with gasoline motor

have previously been experienced all the old litter should be removed and new litter put in after the pens have been completely disinfected.

When the hen house is to be completely cleaned it is best to remove all the old litter first and then start at the top and work toward the ground floor. The usual procedure is to sweep down all dust from the overhead parts of the pen. Then the floors, roosts and nests are generally soaked down and scraped. Hot water and lye at the rate of one can of lye to five gallons of water will do a good job, but care must be taken to prevent the operator from getting burned by this caustic solution. Some of the larger poultry farms have steam pressure cleaners to do this work. All nests, roosts, waterers and feeders need to be cleaned and disinfected.

When the house is cleaned is an excellent time to check the building for signs of rats and mice. The new Warfarin poisons, when properly used, will do a good job of ridding the premises of these pests.

Housing The Pullets

The use of vaccination and inoculation for the various respiratory diseases will be governed by conditions in the community, but all programs should be completed before the birds start to lay.

Pullets hatched in December, January and February usually mature early and start to lay in the spring and early summer. On many farms it is standard practice to keep these birds on range until late the next fall when they are disposed of as they start to molt. Good egg production may be obtained if the birds are kept comfortable with adequate shade and satisfactory nesting equipment. Plenty of feed and water should be available in the shady spots to encourage the birds to eat enough to maintain good production.

Pullets should be housed on the basis of their sexual maturity. Plan to make several selections and pick out the most mature birds each time for housing.

Later hatched pullets coming into production in the fall should be housed by the time they are laying 10% or are old enough to lay. And even then the most mature birds should be housed separately.

The watchword in handling mature pullets should always be "handle with care". Always pick birds up by both wings or both legs. Mortality from ruptured egg yolks may occur if pullets are handled roughly.

If the birds are housed in the daytime it is well to drive them out of the range shelters into catching pens where they can be handled much easier. It is possible to do a better culling job in the daytime and the birds will get accustomed to their new quarters faster if they have a chance to look things over before bed time. A little grass spread over the new

litter will make the birds feel more at home if they have been range reared. If roosts are used it is very important to make sure that all the birds are on the roosts the first few nights.

Great care must be used the next few days after the birds are housed so they will not become frightened in their new surroundings. Open doors carefully and avoid any sudden movements that might scare them. Occasionally some of the birds are too frightened to come down off the roosts at first and in this case feed and water should be placed on the roosts.

In all cases the mash hoppers and waterers should be on the floor the first few days and as far as practicable they should be the same type of hopper and waterer to which the birds are accustomed. Also it is recommended that any change in the feeding program not be made until after the birds are adjusted to their new quarters. Nests of the same type used on range should also be available at the time birds are housed.



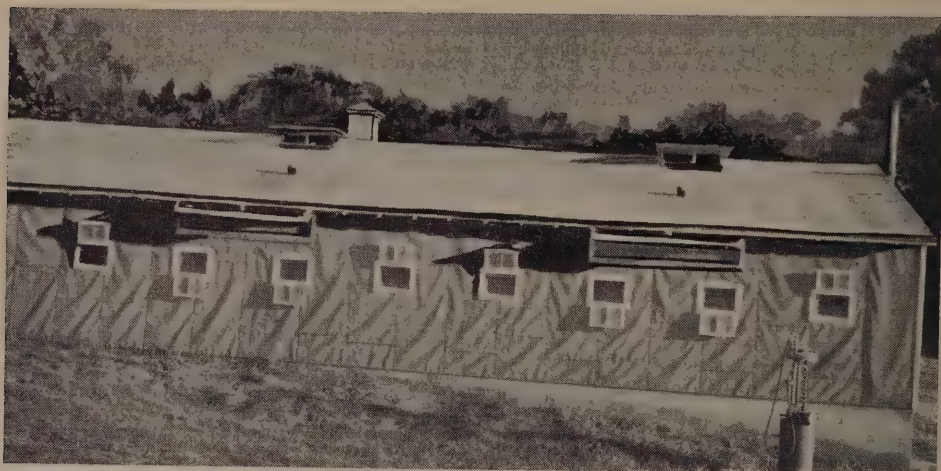
Attention ladies, a gentleman approaches

Heat Protection

July and August are the months when heat prostration is most likely to occur in the laying flock. The danger hours are from noon to six o'clock in the afternoon on days when the temperature and humidity are high and there is little or no breeze blowing. Hens suffer severely at 95° F. temperature and at 97° F. may die. When the temperature approaches this limit the poultryman must take fast action. Three things can be done: (1) put more waterers where the birds can reach them easily; (2) create moving air by the use of fans; and (3) connect a garden hose to the water system and spray the litter. If necessary wet the walls and ceiling so that the water drips on the litter, or sprinkle the birds themselves.

Before hot weather arrives the poultry buildings may be heat-proofed by painting the roof with white paint or an aluminum asphalt paint made especially for that purpose. A white roof can make a difference of 10 to 15 degrees in the temperature of upper floor pens.

The loss from too much heat is not confined to mortality alone. High



White roofs can reduce temperatures in upper floor pens by as much as 10 to 15 degrees. Roof shown above has been painted with an aluminum asphalt paint especially made for heat-proofing

temperatures may result in reduced feed intake and a drop in production. It is well known that egg size is reduced in hot weather. At a temperature of over 90° F. layers cannot readily assimilate calcium, which results in poorer egg shell quality.

Summer Laying Shelters

The summer laying shelter has come into general use on many poultry farms. It provides a satisfactory and economical method of increasing bird capacity at a minimum of expense.

This type of shelter provides satisfactory summer and fall housing conditions for the older hens to finish out their laying year. For this purpose the hens should be moved out as early in the spring as the weather permits. Moving laying hens after hot weather starts may cause them to molt. These birds can generally be left in this type of shelter until late fall or until they start to molt.

A second use for these shelters is to provide laying accommodations for early hatched pullets. These pullets coming into production as warm weather approaches may be kept in the shelters all summer and fall. In many cases these early hatched pullets are sold when cold weather comes instead of being moved into the permanent quarters.

A third use is to provide a place to move early hatched pullets or broilers when the brooding units become too crowded. In this case the birds are usually moved out when they are about six to eight weeks old and require only a moderate amount of heat. Enough heat is provided to control the dampness and to keep the birds from crowding. When used this way the ends and sides of the buildings must be closed in tight enough to keep the birds comfortable.

Some poultrymen also use these buildings as brooder units to start the baby chicks. Here, again, the buildings must be tight and some precaution taken against rats. Brooder units of this type are undoubtedly more expensive to heat than regular brooder houses but will provide extra space if it is needed.

A shelter 24' x 24' will hold 350 layers and one 24' x 36' will hold 500 layers if the birds have limited yard space and plenty of shade to keep them comfortable. Running water and lights are necessities for economical operation. Adequate hopper and nest space are also necessary if good results are expected from these birds.

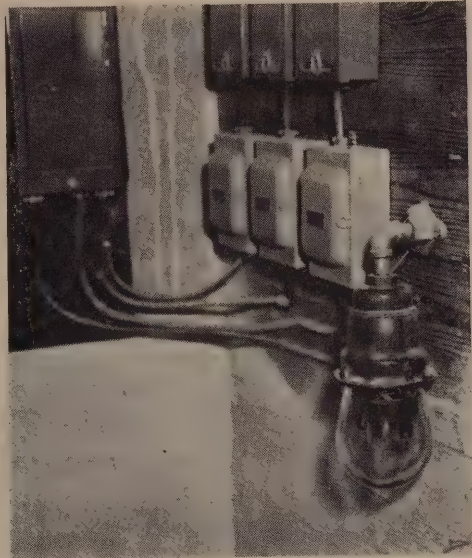
Artificial Lighting

The use of artificial lights is an established practice in order to obtain maximum egg production during the late summer, fall, and winter.

Extending the natural hours of daylight by the use of artificial lights stimulates glandular activity which results in increased egg production and greater feed intake. Artificial lighting also increases the ability of the laying flock to keep in good physical condition under high egg production and adverse weather conditions.

Allow 60 watts of light for each 200 square feet of floor space in laying pens. The use of reflectors increases light intensity. **LIGHT BULBS SHOULD BE CLEANED FREQUENTLY.** Early hatched pullets should have lights by the first of August; normal season hatched pullets as they reach 40 to 50 percent production; late hatched pullets by the middle of October. Lighting late-hatched pullets will help to hasten maturity and bring them into production earlier. Yearling hens and fall hatched pullets should be lighted in July.

Use artificial lighting to maintain a minimum light day of fourteen hours. There are several lighting systems in practice. The most common one is the use of morning lights. With morning lights, no dimmer system is required. There are several makes of automatic time clocks that will turn lights on and off at the operator's will.



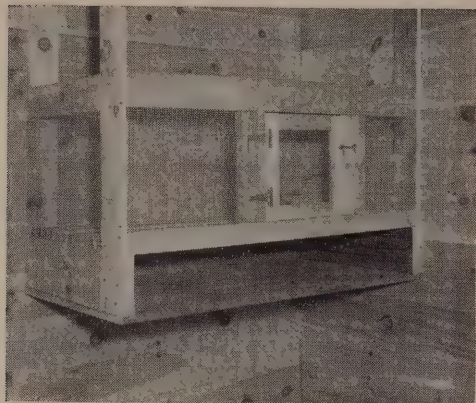
An electronic bulb, sensitive to light intensity, controls poultry house lighting automatically. When lights are to be turned off after dark it must be used in conjunction with a time clock

A second system is the use of morning and evening lights. One advantage of this system is that it makes the chore routine the same regardless of the duration of daylight. It is obvious that with this method of lighting used after dark, a dimmer system is necessary in order to get the birds on the roosts before lights are entirely shut off.

A third system is the use of evening lights only. Turn them on as dusk approaches in the afternoon and continue them until the minimum of fourteen hours of light day has been met.

A fourth system is the use of all-night lights. This system is used successfully on fall-hatched and early hatched pullets that are being forced for egg production during the season of highest egg prices and are not carried over for a full laying year.

All-night lights may be used on these pullets as soon as they come into production. All-night lights may also be used for yearling layers beginning in early July.



Broody coop with slatted floor

Broodiness

It has been demonstrated at egg-laying contests and in certain controlled experiments that broodiness and intensity are in some way related to each other. An intensive or rapid rate of lay is desired.

Broody birds have demonstrated their ability in many cases to equal or exceed the production of their non-broody sisters within the same strain. When a laying hen becomes broody there is a rise in body temperature, and she becomes fretful and anti-social. She seeks a secluded spot and the comfort of the cooling surface of a nest of eggs.

Poultrymen with strains of birds showing broody tendencies have no other alternative than to handle them to the best advantage. Improper handling of these birds can account for a difference in production of from 10 to 20 percent in some strains.

Do not abuse broody birds. A hen which has been broody for one day may be "broken up" and back in production in a short time. Usually two days' confinement in a wire-floored or slatted broody coop with ample feed and water will prove sufficient time to accomplish this. For every day that a bird is allowed to stay on the nest, additional days of production are lost. For example, it may take as many as 10 days to "break up" a bird that has been broody on the nest for three days.

Female hormone preparations are now available which show promise in controlling broodiness.

Culling

One of the important requirements for a successful poultryman is his ability to cull laying birds.

A Culling and Selection Chart

FOR JUDGING PRESENT PRODUCTION

<i>Indications</i>	<i>Laying Hen</i>	<i>Non-laying Hen</i>
Vent	White, large, oblong, moist	Small, round, yellow, dry
Comb	Large, red, full, silky	Small, pale, scaly
Pelvic Bones	Wide apart, pliable	Close together, rigid
Wattles and Earlobes	Prominent, soft	Shrunken, rough, dry

FOR JUDGING PAST PRODUCTION

	<i>Laying, Long Duration</i>	<i>Laying, Short Duration</i>
Vent	Bluish white	Flesh colored
Eye-rings	Thin, edges white	Thick
Eyes	Prominent, sparkling	Listless, sunken, dull
Beak	White	Yellow-tinted
Face	Lean, free from yellow color	Beefy, or hollow, yellowish
Shanks	White, thin, flat	Yellowish, round, full
Plumage	Worn, dry, close-feathered	Smooth, oily, signs of molting, loose-feathered

FOR JUDGING RATE OF PRODUCTION

	<i>High Producers</i>	<i>Low Producers</i>
Keel	Long, slopes downward	Short, slopes upward
Back	Long, broad, width carried back	Short, narrow
Body	Deep, both front and rear	Shallow
Heart Girth	Wide	Narrow
Capacity (Pelvic bones to keel bone)	Deep (four to five fingers)	Shallow or full of hard fat
Abdomen	Soft, pliable, full	Fatty, hard or contracted
Pelvic Bones	Thin, flat, pliable	Thick, round, rigid
Shanks	Thin, flat, dry	Round, full, smooth
Skin	Loose, thin, soft	Thick, underlaid with fat
Plumage	Close-feathered	Loose-feathered
Comb	Smooth, velvety, full	Shrunken, rough
Head	Deep, flat, wide, width carried well forward	Slopes, long, narrow, beefy
Beak	Broad, short, and stout	Narrow, long and thin
Eyes	Prominent, keen, set well	Small, sunken, turning toward beak

All that is necessary in order to become a good culler is practice. This can be accomplished by keeping the culled birds in a small pen by themselves and watching their performance for a limited time. Two ways of culling are recommended.

The first method of culling is by flock observation. Keep a constant daily watch for birds that stay on the roosts at feeding time and show no particular interest in coming down to eat or drink. Also note others which may be on the floor but are listless, and show no particular interest in the activities about them. That type of bird is probably being slowly emaciated and rendered useless by some form of organic disorder or disease. The sooner these birds are removed from the pen, the less danger there is of their spreading any disease that may be infectious or contagious. This type of culling is about the only practical method when layers are housed in large units or when early or fall hatched layers are kept for a relatively short laying period.

A second method of culling which may be practiced is to round up the entire unit of birds in one end of the pen and handle each bird individually. This is the only method by which poultrymen can eliminate birds with sex organs that inherently or for other causes never have developed to the egg production state. Some birds which appear to be the healthiest, best looking birds in the flock may not be profitable layers and should be removed. This type of culling is especially appropriate where birds are housed in small units.

Continuous culling to eliminate the birds that are falling by the wayside provides a program that is an essential operation in order to maintain high egg production and a greater return from the laying flock.

Feeding

Regardless of the feeding system, the poultryman must feed intelligently and watch feed consumption and the general performance of the birds.

The more feed of the proper kind that a laying bird will consume, the more nearly it will produce to the full limit of inherent ability. There is no economy in trying to skimp on the quantity of feed for laying birds. This does not mean that it is necessary only to keep feed hoppers supplied with feed. Actually, the more often small amounts of feed are placed in the hoppers and the layers clean up this feed, the more the birds will eat.



Mechanical feeder saves time and labor

There is a direct relationship between the amount of feed consumed and the number of eggs laid. A drop in the amount of feed consumed is usually followed in a

few days by a drop in production. It is good practice to weigh feed and keep an accurate check on what the birds are consuming from day to day and week to week.

Another satisfactory method is to use the "clean up" system of feeding. This means putting in the mash hoppers only the amount of feed that will be cleaned up by the same time the following day. If the hoppers are empty in advance of the regular feeding time the birds should be given more. If there is feed left in the hoppers, they should be given less.

Feeding Systems

There are two general systems of feeding laying birds. One is known as the "Mash and Scratch" system and the other, the "Complete Ration" system. Satisfactory results may be obtained using either system.

The complete ration system of feeding layers may be used regardless of the system used for rearing pullets. The pullets may be changed to Wirthmore Complete Egg Ration when the first eggs are laid. They should be changed not later than when production reaches 10% or when pullets are old enough to lay. A change from a complete growing ration to a complete laying ration can be made abruptly at this time. If the scratch and mash system has been used in rearing, change the mash more or less abruptly, but discontinue the scratch feed gradually over a ten-day to two-week period until it is eliminated and pellets substituted in small amounts. The complete ration system is especially suited to use with a mechanical feeder.

Wirthmore offers two complete rations for the production of market eggs — Wirthmore Complete Egg Ration and Wirthmore Hi-Ener-G Layer.

Wirthmore Complete Egg Ration

Wirthmore Complete Egg Ration is available in both mash and pellet form. It is generally considered that greater consumption of complete rations is obtained by placing in the hoppers the amount of mash that will be cleaned up just before it is time to feed on the following day.



Homemade bag elevator

Feed Wirthmore Complete Egg pellets with the mash to maintain bird weight and support high egg yield. Begin to use the pellets when pullets start to lay. Feed two quarts (3 lbs.) per 100 birds daily at first, increasing the amount as needed to secure high total feed consumption without allowing the pellets to replace or reduce the quantity of mash eaten. Late afternoon feeding of pellets is usually practiced although they may be fed at anytime of day to suit the convenience of the poultryman. It is usually not necessary to substitute pellets when a mechanical feeder is used.

Along with Wirthmore Complete Egg Ration and pellets, birds should be supplied with fresh water, oyster shells and insoluble grit or limestone grit alone, for satisfactory results.

Scratch grain should not be fed with complete rations. The addition of scratch grain causes the total ration to become unbalanced and reduces its efficiency.

Wirthmore Hi-Ener-G Layer

Wirthmore Hi-Ener-G Layer meets the requirements of market egg producers who desire a low fiber, high efficiency type laying ration. It is a complete feed, available in both mash and pellet form. With compact Hi-Ener-G Rations the need for pellet supplementation is not critical, but a feeding of pellets to laying or breeding birds once daily is an aid to full feed intake by each individual in the flock. Feeding directions for Hi-Ener-G Layer are identical to those given above for Wirthmore Complete Egg Ration.

The Mash and Scratch System

Wirthmore Laying Mash is recommended for the production of market eggs. Scratch grains should be fed with Wirthmore Laying Mash. Feed Wirthmore Laying Mash to pullets when first eggs are laid. They should be changed not later than when production reaches 10% or when the birds are old enough to lay. Give the flock each day as much mash as will be cleaned up just before it is time to feed the following day.

On some farms scratch is kept before the birds in separate hoppers, using one feeder of scratch to two feeders of mash. This method of feeding scratch is not adapted to all strains of birds. It gives a greater opportunity for some birds to unbalance their ration by an over-consumption of scratch.

It is recommended that in general the scratch-mash allotment be kept within the 40-60 ratio. By this is meant the consumption of hard grain should not go below 40% or over 60% of the total feed consumed. Some strains of birds may lay at a heavier rate with less than 40% scratch grain feeding. When birds are nearing the end of their laying year, it may be advisable to feed less than 40% scratch grain in order to encourage production.

The quantity of hard grain consumed should vary with the total feed intake. More feed will be required by pullets as production increases. Therefore, the scratch should be increased in proportion as the total feed consumption of the bird increases, or when the birds are losing body weight. When a drop in production takes place without any loss in body weight, a reduction in the scratch grain is advisable. Scratch grains should be given in the late afternoon.

To increase feed intake and to maintain correct mash and scratch ratio, feed three to six pounds of wet mash, or three to six pounds of pellets to each 100 birds. The amount of pellets may be increased up to 25% or even more, of the total feed consumed during days of adverse weather or under other abnormal conditions. Consider the pellets or wet mash as part of the mash intake when determining mash and scratch ratio.

The feeder who tries to step up total feed consumption by increasing the amount of hard grain at the expense of mash consumption is likely to be headed for trouble. The added hard grain tends to dilute the proteins, vitamins, and other materials which are necessary for the production of eggs, and for body tissue replacement.

Experimental work has shown that a certain level of all nutrients is necessary not only to promote egg production, but to maintain body weight and health. Other than the general recommendations given above, it is impractical to present figures regarding the amount of hard grain to feed, due to demands of the different strains and breeds of birds and varying conditions of environment. A close check on body weight and production as well as the total feed consumed should provide the real answer to the problem.

Always keep oyster shells and hard grit (or limestone grit alone) and fresh water available.

Wirthmore Poultry Flush

This specialized feed is used on some farms to sharpen appetites and "tone-up" the birds. It is fed as the entire mash ration for one-half day and



Track and carrier, a great labor saver with large units of birds

then repeated after a period of two weeks or a month if necessary. This feed may be used as a conditioner and fed as a supplementary wet mash in addition to the regular dry mash being fed.

Poultry Fitting Ration

This is essentially a molasses-sweetened scratch feed designed to stimulate appetite by its mild laxative action and to provide a variety of grains suitable for supplementing growing and fattening feeds. It has exceptional appetite appeal and is most effective as a tool in the hands of the poultryman for encouraging feed consumption.

A good rule to follow is to feed 3 to 4 pounds of this feed per 100 birds once a day — distributed over the number of mash hoppers in the pen.

Wirthmore Super Pellets

Wirthmore Super Pellets are of the “booster” type, to be used when birds have been depleted and are generally run down because of disease or other causes.

This feed is highly potent in those factors supplied by Vitamin A and D oils, alfalfa, and dried milk by-products.

Use Wirthmore Super Pellets for the following purposes:

1. To aid recovery from disease.
2. To recondition molting hens and pullets.

Severity of conditions governs the quantity of Wirthmore Super Pellets to be fed. Not less than two quarts (3 lbs.) per 100 birds daily should be used. When conditions are severe, as much as 75% of the total feed intake for a short period may be Wirthmore Super Pellets. It is not necessary to continue feeding Super Pellets when the abnormal condition has been corrected.

Feeding Caged Layers

A caged layer requires a very exacting ration as it is entirely dependent upon what is put in the feed hopper.

Wirthmore Complete Egg Ration is recommended with Complete Egg Ration pellets as a supplement. Birds in laying cages should be put on Wirthmore Complete Egg Ration when production starts.

The recommended method of feeding is to give each layer the amount of feed she will clean up before the next regular feeding time. The clean-up system tends to keep the birds' appetites sharp and does not permit feed to become stale or musty in the hoppers.

Pellets may be fed in small amounts by the time caged layers are laying 20% to 25%. They can be fed in the late afternoon in amounts that will



Grain room on second floor makes for easier feed handling and delivery

be cleaned up the next morning. A good goal to keep in mind between mash and pellets is to have the pellet feeding not exceed 40% of the total feed intake.

Scratch grain should not be fed with any caged layer feeding program. Oyster shells and hard grit or limestone grit alone may be fed twice weekly on top of the mash in the hoppers. Care should be taken to prevent accumulation of these materials in the hoppers. If a separate compartment with the caged unit is provided, oyster shells and grit may be kept constantly before the birds.

Birds in laying cages must have a constant supply of clean water. Just a few hours without water especially in hot weather oftentimes will throw birds out of production and into a complete molt.

The Breeding Flock

THE Northeast still holds the top position as a source of good breeding stock including adult birds, baby chicks and hatching eggs.

One of the basic reasons for this probably can be traced to the eradication of Pullorum Disease to a high degree. Some credit for this must also be given to the fact that several of the more popular breeds or varieties of poultry originated in this area. But the basic reason lies in the type of men who have made poultry breeding their business. Their vision, courage and skill have been outstanding. When measured by such yardsticks as the egg-laying contest and the R.O.P. records in the case of the production bird or the Chicken-of-Tomorrow Contest for the meat bird, these breeders stand out as leaders in their field.



Interior of a modern breeder building

These poultrymen may be classified as follows:

1. Foundation breeders
2. Reproducers
3. Hatching egg producers

Foundation Breeders

Foundation breeders are those who have developed strains of birds known for certain definite characteristics. They are highly skilled specialists. Usually they are large operators with trained employees carrying out the many operations involved. This group is comparatively small but for those who arrive at or near the top the rewards are high.

Most of the members of this group are so-called pedigree breeders who, by the use of the trapnest, select the families which come the nearest to reaching the goals sought. Enormous quantities of records must be kept and carefully studied in order to select the comparatively few families used in the pedigree matings.

These selections involve many points but among the more common are:

1. Size and number of eggs (intensity and persistency)
2. High hatchability
3. Livability
4. Rapid feathering
5. Rapid growth
6. Nonbroodiness
7. No winter pause
8. Body confirmation (meat qualities)
9. Disease resistance
10. Feed efficiency

Such breeders serve as a reliable source of high quality stock for other poultrymen.

Other breeders perform an excellent service in developing desirable characteristics in their strains through flock selection and flock mating.

Reproducers

Reproducers serve to greatly expand the distribution of a foundation strain far beyond the physical limitations of the pedigree breeder. Usually they purchase chicks or eggs from the same source every year or every two years to improve or replace their flock. They may sell hatching eggs as well as baby chicks.

Hatching Egg Producers

A poultryman who buys baby chicks, flockmates the pullets reared and sells hatching eggs is a hatching egg producer.

Freedom from disease and flock vigor is the goal set by the good hatching egg producer.

Cooperation with the U. S. Department of Agriculture in the National Poultry Improvement Plan helps in keeping hatching egg producer flocks in good standing with the hatcheries taking their eggs. Most hatcheries require that all birds from which eggs are saved be blood tested and found free from Pullorum before eggs from those birds are shipped for hatching purposes.

Source of Stock

The hatching egg producer should consult with the hatchery manager or flock supervisor in regard to the type or source of stock desired. This demand usually falls into one of three groups:



A modern chick delivery van

1. Efficient egg producers.

This classification includes most strains of Rhode Island Reds, Barred Rocks, White Leghorns, Wyandottes and White Rocks and some strains of New Hampshires. A huge demand has developed for the so-called sex-linked (black) pullet. This pullet results

from the crossing of Barred Rock females and Rhode Island Red or production-bred New Hampshire males. Where this type of cross is especially popular it has become common practice to name the strain of Red males used and in many cases also the strain of Barred Rock females used in the sex-linked mating. In-crossbreds (inbred-hybrids) have increased in popularity among egg producers in the Mid-west. The term in-crossbreds means the offspring produced by the combination of inbred lines of two to four different breeds or varieties of poultry. An inbred chicken is the offspring of two related parents, such as brother and sister. The degree to which the offspring is inbred depends on how closely the parents are related but more particularly on the number of generations of in-breeding of the parent stock. This phase of poultry breeding is in its infancy.

The hatching egg producer who caters to the type of market covered in this classification (efficient egg producers) is primarily concerned with stock that will assure a high yearly egg production. This ability, however, must be coupled with other desirable qualities such as good egg quality, egg size, livability, early feathering, early maturity, low incidence of broodiness, etc.

2. Meat type birds. In meat type birds the primary consideration is for rapid and efficient growth, with a plump or blocky conformation,

early feathering and good livability or the ability to stand up under mass production conditions. Among the straight breeds, meat-type New Hampshires and meat-type White Plymouth Rocks continue to hold their popularity as efficient meat producers with the strain name being important.

Popular among the numerous meat-type crosses are the Barred Cross, meat-type Barred Plymouth Rock male x a meat-type New Hampshire



Several meat type crosses are in demand by broiler growers. (above) Barred Plymouth Rock male X New Hampshire female. (below) Dominant White male X New Hampshire female



female; and Dominant White Crosses, Dominant White male x meat-type New Hampshire female or meat-type Barred Plymouth Rock female.

The absence of black pin feathers in New Hampshires and white breeds and crosses is a trait which makes them popular with dressing plants.



Loading and shipping chicks by rail

3. General purpose. This last group is open to some discussion. Some breeders say that a bird has to be either an egg producer or meat-type, while others say great strides have been made in developing a general purpose bird. There are many strains of the heavier breeds, such as New Hampshires, White Plymouth Rocks, and Barred Plymouth Rocks

which might be placed in the general purpose category. The buyer of this type of bird, however, is more likely to want cross breeds. The most popular cross in this respect is the same sex-linked black pullet mentioned above. Many poultrymen within trucking range of New York City grow this type of bird for the black pullet roaster market. If the pullet market is poor and the egg market is good when these birds reach maturity they may be kept as layers, hence the dual-purpose characteristics of this cross are of real interest to this group of chick buyers.

Although separate and distinct characteristics are sought in each of the three general groups described, there are other qualities that are common in all groups:

1. Health and vigor
2. High hatchability
3. Freedom from undesirable breed disqualifications or defects.

The first two factors are governed by management and nutrition as well as by inheritance, and in no small measure are linked together. In fact, after the hatching egg producer has secured his stock in any one year his main effort is to keep his birds as healthy and vigorous as possible in order that production and hatchability may reach its inherited maximum.

Hatching Egg Costs

Production of hatching eggs is more costly than producing market eggs. Added costs include:

1. Lessened laying house capacity for layers due to space occupied by males.
2. Cost of males, their feed, depreciation and mortality.
3. Possible lower production as a result of "wear and tear" on females, also as a result of strain of bird demanded by the hatchery.
4. Possibly slightly higher layer mortality.
5. More labor due to more rigid culling, blood-testing, more frequent egg collections and more rigid egg grading.
6. Additional cost of breeder rations over those used for producing market eggs.

The following estimates prepared by Extension Service, University of Maine, College of Agriculture, cover the extra costs of producing hatching



Pedigree breeding requires the extra labor of trapnesting and recording leg-band numbers on each egg collected

eggs over market eggs. They are measurable costs only and do not include such debatable items as "wear and tear" on the birds, lower meat values of breeders when sold, greater mortality and possible sacrifice of production because of necessity of stocking a specialized "meat strain" of birds.

The cost of keeping males is figured by the simple method of assuming that the feed, labor and overhead involved in keeping a male would have supported an additional layer; therefore, the value of the eggs produced by the hens thus replaced by males is a proper charge against the hatching egg enterprise. This method assumes that the costs of maintaining a male in the breeding pen will be the same as for a pullet. However, since it costs more to raise a breeding cockerel to maturity and the sale value at the end of the season will be less than for a pullet, depreciation will be higher on males. Therefore, an additional one dollar for extra depreciation is added.

Cost of Producing Hatching Eggs (1000-Bird Flock)

Pullorum Testing.....	\$ 40.00
Extra Cost of Breeder Ration 1000 cwt. 10¢.....	100.00

Cost of Keeping Males:

Replacement of 80 hens @ 12 dozen eggs per hen = 960 dozen @ 55¢.....	528.00
Extra Depreciation Males — 80 @ \$1.00	80.00

Total costs.....\$748.00

Costs Per Dozen Hatching Eggs Sold

Assuming a production rate of salable hatching eggs of 40%
(50% to 60% actual production).

2000 dozen (9 weeks production).....	\$.37
4000 dozen (17 weeks production).....	.19
6000 dozen (26 weeks production).....	.12
8000 dozen (34 weeks production).....	.095
10000 dozen (43 weeks production).....	.075
12000 dozen (51 weeks production).....	.065

Premium Prices

Hatcheries usually pay a premium over the current wholesale market price for large table eggs. It usually varies from 20¢ to 35¢ per dozen. Many hatcheries offer an additional premium for better than average hatchability. Premiums may vary with the supply and demand and also to some extent with the type of birds mated.

Meeting The Demand of Hatching Egg Receivers

It is advisable for the poultryman who is making plans to produce hatch-



Individual buildings for pedigree matings

ing eggs to discuss the matter of the choice of breeds and strains or crosses with the prospective receiver of his eggs. By doing this it is possible to make plans to meet their particular requirements.

The hatcheries have two types of customers, the poultry meat producer and the table egg producer. They desire different types of birds. The



Birds showing good feathering (left) poor feathering (right)

poultry meat producer, usually a broiler or roasting chicken raiser, requires a fast growing, rapid feathering type of bird with high livability, which finishes with good meat qualities on the lowest possible feed conversion in from 10 to 18 weeks of age. This is a year around business. The table egg producer requires livability, high production, and egg quality. The demand for hatching eggs from egg production strains is limited principally to the winter and spring months.

It is generally most profitable to sell hatching eggs during the peak of production, which is the first six months of laying. It is desirable to have the peak egg production come during the season of highest egg prices.

A study of the wholesale egg market over the past six years shows that the highest egg prices occur during the months of June through October. It has been during late October and November that prices have receded to reach a low point during the month of February only to advance through the spring and summer months until the high point is reached, usually during September.

Markets For Hatching Eggs

Commercial hatcheries or breeder hatcheries are the ultimate markets for hatching eggs. The poultryman may sell his eggs to handling agencies which pick the eggs up at the farm, through brokers, or direct to hatcheries.

Some hatcheries have what is known as supervised flocks, that is, the farm is producing eggs of a particular strain or cross for a particular hatchery. The hatchery has a supervisor calling regularly and often these hatcheries have their own egg pickup service.

Factors That Influence Hatchability and Chick Quality

The breeding flock should be handled with care so as to get the best production, livability, fertility, hatchability and good chick quality. A good management and feeding program will pay dividends. The hatchability factor is inherited, and can be maintained or improved on foundation breeding farms through trapnesting, pedigree breeding and progeny selection. The average producer of hatching eggs would do well to secure foundation stock from such farms.

Breeders must be hardy and vigorous and possess plenty of rugged vitality in order to stand up under the "wear and tear" in the breeding pens.



Break up broodiness quickly by use of a broody coop

Physical fitness should be the first consideration in selecting individuals. All birds that appear to lack health and vigor should be discarded. Handle the remainder of the flock to determine body shape, capacity, development and flesh condition.

Further selection should be made on the basis of maturity, comb size, uniformity in weight and size, feather color pattern and other requirements of either the flock owner or the purchasers of the hatching eggs. When ordering chicks, it is well to order from 20% to 25% as many cockerels as pullets in order to have enough to make a good selection. It is desirable to have the cockerels a month older than the pullets. The cockerels should be culled several times during the growing period so as to have only the best possible males at maturity.

Healthy birds are essential to any poultry enterprise and particularly so where hatching egg production is concerned. In the event of an outbreak

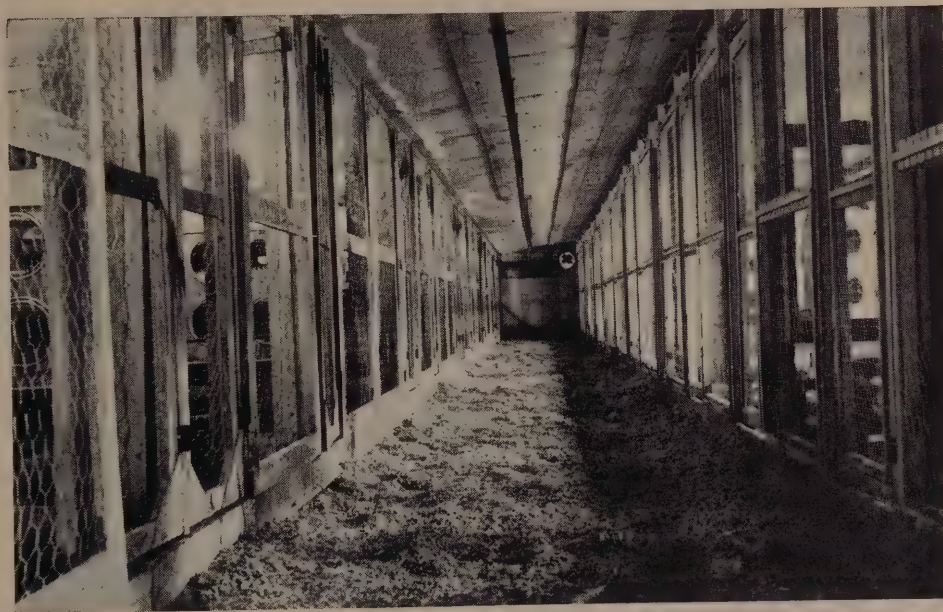
of disease in a flock, the producer should immediately notify the receiver of his hatching eggs. Shipments should cease immediately and not be resumed until the trouble clears, or until the receiver of the eggs orders otherwise.

Securing Started or Mature Cockerels or Pullets

There is danger of spreading disease when bringing started or mature cockerels or pullets to the farms. These birds may have fully recovered from some ailments so far as visible appearance is concerned, yet may still be carriers. The safest plan is to buy only hatching eggs or day-old chicks.

Housing Comfort

Housing plays an important part in poultry management. Breeders should be given clean, disinfected pens, well lighted and free from drafts, dampness and excessive changes in temperatures.



Pedigree mating pens

When houses are cold and damp there is a tendency for birds to eat and drink less, thus causing a drop in egg production. Freezing of combs causes the males to be inactive.

Hot and poorly ventilated pens will tend to result in lower fertility and hatchability. Pens insulated and equipped with windows and ventilators, water kept from freezing and deep dry litter will help keep the breeders comfortable and healthy. Care must be taken to prevent sudden changes in pen temperatures.

Houses and Equipment

The same housing and equipment is required for birds kept for breeders as is needed for those kept for market egg production except that the number of pullets is reduced to make room for the necessary number of males.

Lights

Most poultrymen use lights on laying birds in order to hold up production during the shorter days of the year. Lights stimulate the pituitary gland



A large dairy barn remodelled to house breeders

which tends to increase egg production. Many houses do not have a sufficient number of light bulbs or wattage. A good rule is to use one 60-watt bulb for every 200 square feet of floor space.

Keep Light Bulbs Clean!

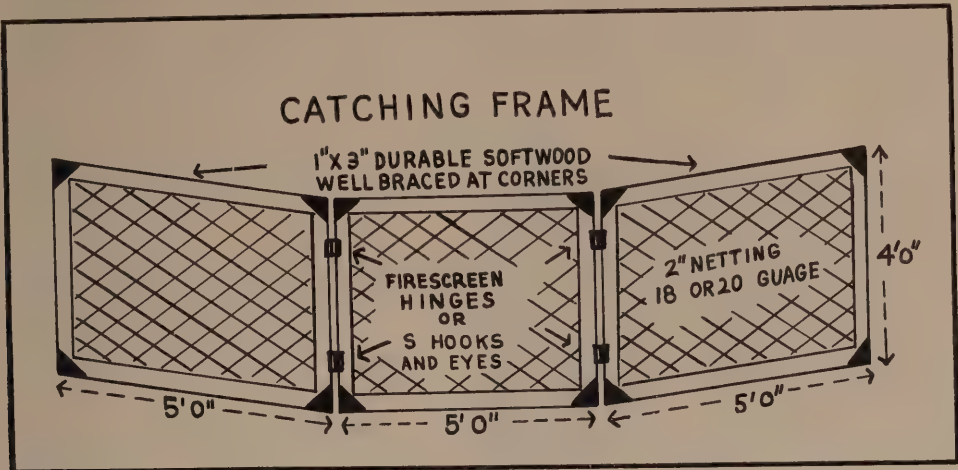
Provide a minimum light day of 14 hours. Some of the meat type birds need a 14 to 16 hour day. For further lighting information see chapter, **THE LAYING FLOCK**.

Fertility

Some of the causes of low fertility may be too many or not enough males, poor condition of males, frozen combs, immature males, and molting males and females. Males should be reduced in number every time the pullets are culled in order to keep the proportion of approximately seven males per hundred pullets.

Molting of either males or females will cause low fertility. Molting males should be culled.

Introducing individual males into the pens may temporarily cause fighting and lowered fertility. If possible, all males should be changed as a unit if new males must be added to a mated pen. Place the new individuals in the pen after dark,



Suggested plan for portable catching frame to aid in culling

Eggs will continue to be fertile for about one week after males are taken out, although some individuals may continue to produce fertile eggs up to three weeks after males are moved. If females are remated to different males, wait about two weeks before saving eggs from the new mating.

Hatchability

Poor hatchability may be caused by one factor or a combination of several factors such as an inherent characteristic, disease outbreaks, poor condition of breeders, birds in molt, drop in production, poor condition of pens, inadequate equipment, poor handling of eggs, and failure to feed a breeder ration.



A pan type waterer on slatted platforms aids in keeping breeder pens dry

Some strains are bred for high hatchability while others have low hatchability regardless of care and feeding.

When hatchability drops, check to see what is wrong. Eggs should not be saved until the cause has been determined and corrected since low hatchability may result in poor chicks.

Culling all birds that are out of condition will improve hatchability and percentage of egg production. Check and find out why birds are thin or in molt. It may be a management problem rather than a fault of the birds.

Condition of Breeders

Check the flock at regular intervals to see if their flesh condition is good. Handle birds on roost at night or while they are in the nest. If birds are losing weight it may be a management problem, such as too few feed hoppers, dark pens, crowding, wet litter or insufficient waterers. Check the feeding program.

Good laying birds should hold or gain in weight through the laying year. Off-condition breeders will give trouble with fertility and hatchability. Good body weight and flesh condition are essential to good egg production and continued high hatchability. If birds are housed with good body weight and flesh and this condition is maintained, good results in the months that follow can be expected.



Access to shaded areas, especially during hot weather, is helpful

There is a direct correlation between fertility and the flesh condition of the males. Cockerel feeders should be placed on the wall or on posts above the reach of the pullets and filled with pellets or scratch feed to give the males access to the extra amount of feed needed to maintain good body condition.

Reconditioning Second Year Breeders

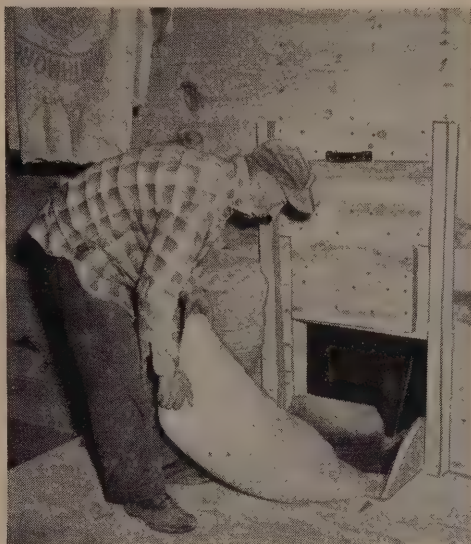
Breeders to be used the second year should be given a rest of two to three months. Birds can be forced into a molt by restricting feed and water. As soon as birds start to molt resume regular feeding. Feeding Wirthmore Super Pellets helps to bring the birds back sooner and in better condition. Forced molting will give more eggs when needed with better hatchability, fertility and stronger chicks.

Breeder Rations

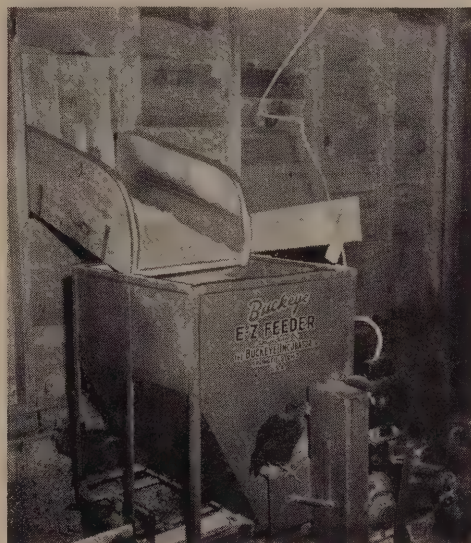
Wirthmore breeder rations contain all the nutrients necessary for high hatchability and the production of quality chicks. Birds to be used as breeders should be fed a breeder ration four weeks before eggs are saved for incubation purposes. Either the complete ration system or mash and scratch system may be used. Under average management conditions, better results will be obtained with the complete system.

Wirthmore Complete Breeder Ration and Wirthmore Hi-Ener-G Breeder

Either Wirthmore Complete Breeder Ration or Wirthmore Hi-Ener-G Breeder should be fed when pullets reach 10% production. If they are raised on mash and scratch, change from the mash used to either of the above complete rations, and take two weeks to gradually discontinue the use of scratch grain. Change laying birds to either Wirthmore Complete



Feed bags are emptied into chute (above) which supplies mechanical feeder (below)



Breeder Ration or Wirthmore Hi-Ener-G Breeder four weeks before saving eggs for hatching. Keep oyster shells and insoluble grit, or limestone grit alone and water available to the breeder flock at all times.

General feeding directions and details regarding pellet feeding for Wirthmore Complete Breeder Ration and Wirthmore Hi-Ener-G Breeder do not differ from those of Wirthmore Complete Egg Ration or Wirthmore Hi-Ener-G Layer. See pages 87 and 88.

Wirthmore Breeder Mash

Start to use Wirthmore Breeder Mash and scratch when pullets reach 10% production. Wirthmore Breeder Mash should be used four weeks before saving eggs for hatching. Under most conditions Breeder Mash and scratch should be fed at a 50-50 ratio, that is 50% mash, 50% scratch. Breeder Mash should never be less than 40% and can be as high as 65%-70% of total feed intake, depending on the strain of birds, age of birds and the time of year. Always keep water, and oyster shells and hard grit, or limestone grit alone, before the birds.



Large size grit or shell hopper

Further details on feeding Wirthmore Breeder Mash and Wirthmore Breeder Pellets are essentially the same as those for

Wirthmore Laying Mash and pellets. See page 88.

Wirthmore Super Pellets

Wirthmore Super Pellets may be fed to breeder flocks to help increase hatchability and egg production and improve health of birds due to molt or sickness. Super pellets may replace part or all of regular pellets. For further details refer to page 90.

Handling Breeding Males

Males should be fully matured and in good weight and flesh before they are mated. Immature males usually go to pieces in a short time.

To avoid excessive fighting among males during the growing period, it may be necessary to use high roosts, grandstands, or put on specs, pick guards, or debeak them. Remove the specs or pick guards when birds are mated.

When the males and females have been raised in separate units, males of a different color from the pullets should be added to the pens with extreme care so that frightening of the females does not occur. Place a few males with the pullets before egg production starts or put a few males in a crate and place in the pen for a day or two so that the pullets can get accustomed to them. When pullets are no longer frightened of the males, remove them from the crate and add the required number to the pen. Males should be placed with the females at least two weeks before the eggs are saved for hatching. If the males and females that are to be mated have been grown together they may be housed at the same time.



Health and vigor are of prime importance in a breeding male

Care and Handling of Hatching Eggs

When a fertile egg is laid the embryo is very well protected. The fertilized germ is attached to the yolk which is suspended in the white or albumen part of the egg. This jelly-like portion keeps the potential chick from bumping or rubbing against the shell. In turn, the shell supplies a high degree of protection. Thus nature has done what it can to give the future chick the best possible chance to survive.

From the hour that the fertile egg is laid its chances of hatching depend on the care given it by all those who become responsible for it.

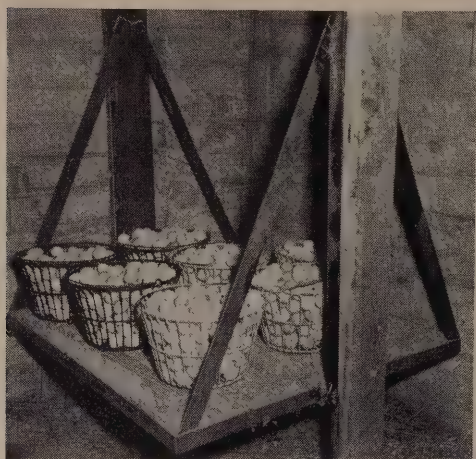
In general the care of hatching eggs differs very little from that of market eggs except that greater emphasis is given to more frequent collections, protection of eggs from long exposure to excessive heat or cold, and the necessity for good egg-holding conditions in respect to temperature and humidity.

Pick Up Eggs Often

Under normal conditions eggs should be collected two or three times a day. During extremely hot or cold weather it is advisable to gather eggs five or six times daily. This will guard against germ development and prevent excessive breakage. Cleaner eggs will also result from more frequent gathering.

Once each week the nests should be checked to see that plenty of clean nesting material is evenly distributed over the floor of the nest.

In pens in which it is difficult to keep the litter dry, nail lattice strips or lathes on the sides and ends of the nest alighting boards. This makes a shallow trough wide enough for the birds to walk in. Keep this trough



An elevator of this type saves labor in handling eggs

filled with hydrated lime or finely ground limestone to help keep the hens' feet dry and therefore cleaner.

In the past washing hatching eggs has not been recommended. There is recent experimental evidence to the effect that by the use of a detergent in warm water, hatching eggs can be dipped, then quickly rinsed or wiped and cooled, without injury to hatchability.

Several types of egg washing machines are on the market. It is essential that the manufacturers' directions be strictly followed in order to avoid damage to the hatchability of the eggs.

Cool Eggs Quickly

As soon as eggs are collected, they should be taken immediately to the egg room to cool as this is one of the important steps leading to high hatchability. There is a close relationship between hatchability and the length of time taken to remove the animal heat from the egg.

The type of container used has a very important bearing on how quickly the eggs are cooled. With an egg room temperature of 50° F. it takes the following time to reduce the internal temperature of the egg to 68° F. (embryo development stops when eggs are cooled to this temperature):

- 15 hours in an egg case
- 9 hours in the center of a galvanized pail (156 eggs)
- 5 hours in the center of a wire basket (156 eggs)
- 2 hours laid 3 deep on a wire tray
- 1 hour laid in a single layer on a wire tray

With a fan running, the eggs in the wire basket will cool in $\frac{3}{4}$ of an hour compared to 5 hours in still air. The moving air also discourages the formation of mold.

50° to 60° and 70% to 80%

This set of figures is a goal for hatching egg shippers to aim at. The figures 50° to 60° should be the egg room temperature at the level of the eggs, while 70% to 80% represents the relative humidity in the egg room where eggs are held until shipped to the hatchery.

Experiments show that exposure to extreme temperatures for over a few hours does affect hatchability very markedly. It is possible that various breeds or types of matings may have different degrees of tolerance to extreme temperatures. It is wise to avoid wide temperature extremes as far as possible.

It is necessary to avoid alternate warming and cooling of eggs. Germination starts at 69° F. and stops when the temperature drops below this figure. Many apparently infertile eggs are actually fertile eggs in which the embryo has been killed by being subjected to uneven temperatures before the eggs were set.

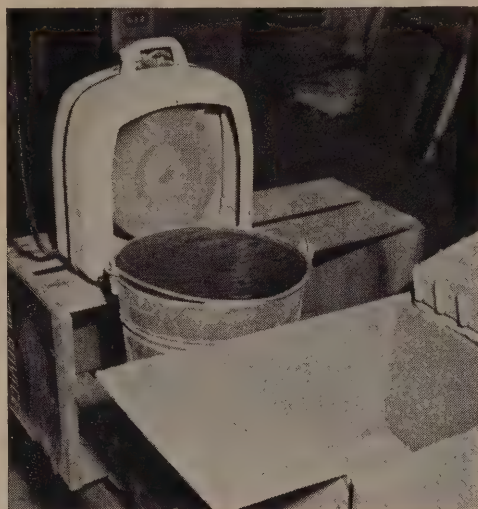
The Ideal Egg Holding Room

During the early days of egg quality improvement work, desirable results tied in closely with low temperatures. Observers didn't seem to realize that the lower the temperature in the egg room, the more difficult it was to secure high humidity and that the combination (not temperature alone) protected the interior quality of the eggs. Little was attempted in the way of mechanical controls and the comparisons seemed to identify holding places that were naturally good. Professor R. E. Jones of Connecticut, studying average room temperatures during June, July and August found the following:

- 31 rooms above ground averaged 67.9° F.
- 40 rooms $\frac{1}{2}$ above ground averaged 64.1° F.
- 130 rooms below ground averaged 62.7° F.
- The best 10 rooms below ground averaged 57.9° F.

The following set of recommendations by Professor Jones is helpful in arranging a good egg holding room:

1. Take advantage of low night temperatures to cool the egg room during hot weather.
2. Take advantage of below ground temperatures — build deep.
3. Use heavy stone or concrete wall construction.
4. Insulate the ceiling, thus taking advantage of the protection offered in a multiple story building.
5. Provide a vestibule or other protected entrance.
6. Take advantage of shade trees to keep the building and the ground cool.
7. Provide shrubbery to protect the side walls.



A fan blowing air over a pail of water is a simple method of supplying humidity in a small egg holding room

8. Take advantage of water seepage at lower levels.
9. Reduce temperature by evaporating moisture on the floors and side walls.
10. Pipe cold water through coils in the egg room.
11. Provide for ventilation.

These recommendations will help keep the egg room cool during summer months; however, most of the provisions also make it easier to provide proper heat (and moisture) during cold weather. In most instances a

laundry stove can be connected with the same coil (No. 10 above) to warm the egg room.

Due to high moisture requirements (70% to 80% relative humidity) a good egg room should be adjacent to, and partitioned off, from the room where the eggs are cleaned and packed.



Hatching eggs should be cooled quickly to hold back germination of eggs

The Cooling and Holding Room

Hatching eggs should be brought to this room as soon as they are collected, as they must lose their animal heat before being packed.

Egg cases should be stored in this room to cool for a day or more before packing eggs into them. Here are a few ideas to keep in mind when planning the egg room.

1. Make it large enough to hold one week's eggs in cases; two days' empty cases cooling down; two days' collections of eggs in baskets (possibly on racks on one wall); heating, cooling and/or humidifying devices; and enough room to move around. A room 8' x 12' would provide ample holding room for a 2000 to 3000 bird flock.
2. This room should be separated from the packing room by an insulated wall. Wallboard should not be used for this partition unless it is waterproofed by painting it with an outdoor paint to prevent absorption of moisture from air.
3. Provide openings near the floor and ceilings, with slide controls, to permit a constant, regulated flow of air. If this flow robs the air of too much moisture, restrict the ventilation and keep the air circulating with a small fan. Moving air also reduces the possibility of mold development.
4. Keep an accurate thermometer and humidity gauge at the level of the eggs, and remember the 50-60-70-80 formula — 50° F to 60° F temperature and 70% to 80% relative humidity.
5. Provide slatted racks (1" by 2" strips nailed to 2 by 4's) to keep the cases off the floor.
6. Before buying mechanical humidifying equipment, try to maintain proper humidity by wetting down the floor and walls.
7. A concrete or brick floor with a drain will simplify the sanitation problem.
8. If eggs are to be set within one week after they are laid they need not be turned.

If they are to be held longer, they should be turned. Pack them in a case, then place this case on a four-inch pipe or pole or on a 4" by 4" piece of timber and tilt the case from end to end morning and night. Additional turning is not necessary.

The Packing Room

This is the room in which the hatching eggs are graded and packed for shipping. Here the main objective is to simplify and speed up the process of packing eggs. Often the whole operation must be built around a mechanical grader.

The following suggestions can be used when planning or replanning the egg packing room:

1. Have it as close as possible to the egg holding room.
2. Provide benches or tables of such height that eggs can be taken from egg baskets and put into the egg cases with a short movement of the arms, rather than involving a back-bend each time. It may sound lazy, but good grading stops when the operator starts to get tired.
3. Provide a bright light (fluorescent lights work well) for shell-grading the eggs, and a candler to check on all eggs with dubious shells. Candle enough eggs from time to time to be assured of their interior quality.
4. Besides the egg scale, grader, candler, and back-saving devices, a properly equipped egg packing room should be supplied with:

An ample stock of new flats and fillers.

A hammer and nails to repair cases.

Tacks for labels — or glue or gummed tape if cardboard cases are used.

A rubber name-stamp and stamp pad, and perhaps a date-stamp.

Cleaning equipment, including broom, mop, clean rags, and trash bin.



Careful grading is a must for the breeder

Select Hatching Eggs Carefully

When eggs are set primarily for laying flock replacements, the selection of the eggs is a necessary part of the breeding program, since females tend to lay eggs of the size, shape, color and texture of the eggs from which they were hatched.

Many close checks have shown that careful selection pays off in higher hatchability. Today, many hatcheries specify the size of eggs desired.

Olsen P. Haynes, Beltsville Research Center, reports a study in which 47,950 freshly laid eggs were candled to determine whether or not certain egg characteristics affect fertility and hatchability. Of this number, 1894 or about 4% had one of the undesirable characteristics. The hatchability of fertile eggs showing these characteristics was as follows:

<i>Characteristic</i>	<i>%</i>
Small eggs (under 20 oz. per doz.)	80.0
Extra large eggs (28 oz. per doz. or more)	70.8
Large blood spot	71.5
Misplaced air cell	68.1
Loose air cell	48.9
Misshapen eggs	32.4
Cracked eggs	53.2
Eggs with poor shells	47.3
Average of all defective eggs	61.8
Average of all good eggs	87.2

Hutt of Cornell found an excessive proportion of malpositions (mostly with the head under the left wing) in large eggs that failed to hatch.

Several exhaustive tests have been run on hatchability as it is affected by egg color. Godfrey of Ohio in 1947 gave the most complete comparison:

<i>Breed of Flock</i>	<i>Light Colored Eggs</i>	<i>Medium Colored Eggs</i>	<i>Dark Colored Eggs</i>
New Hamps — Flock No. 102..	63.38	72.16	76.79
New Hamps — Flock No. 113..	61.19	78.55	77.25
White Rocks	73.81	77.50	80.53
White Rocks (ROP flocks)	71.70	79.28	.....
Barred Rocks	67.46	64.96	74.27

Scales for weighing eggs should be checked frequently. Always use an accurate check weight.

When packing each layer of eggs it is worthwhile to check and see if any eggs are sticking up above the fillers. Eggs that are too long will not stand shipping or give best hatches. Eggs should always be packed small end



Dolly for easy handling of eggs

down. If they should ride with the air cell in the large end, it is likely to become loosened or ruptured.

Several years ago, a test was run at The University of Massachusetts on the effect of jolting eggs in transit. The eggs were candled, hauled over a rough route, and candled again to determine the number of tremulous air cells, broken eggs and cracked eggs caused by the handling. Here are the results:

<i>How Handled</i>	<i>Tremulous Air Cells</i>	<i>Cracked Eggs</i>	<i>Broken Eggs</i>
Eggs hauled in a sedan	0	0	0
Eggs hauled at front end of truck	12 eggs	0	0
Eggs hauled at rear of truck	76 eggs	6 eggs	8 eggs

When transporting the eggs from the farm it is always good judgement to place feed bags or blankets under the eggs for cushioning, another blanket over the eggs to help protect them from either cold or hot weather.

Ship Hatching Eggs Often

It is essential that hatching eggs move to the hatcheries shortly after they are produced as hatchability decreases with age.

Hall and Romanoff, Cornell University, set eggs at different ages and found:

<i>Days eggs held</i>	<i>1-7 days</i>	<i>8-14</i>	<i>15-20</i>	<i>22-28</i>
Percent hatch of fertile eggs.....	77.8%	65.9%	37.6%	31.4%

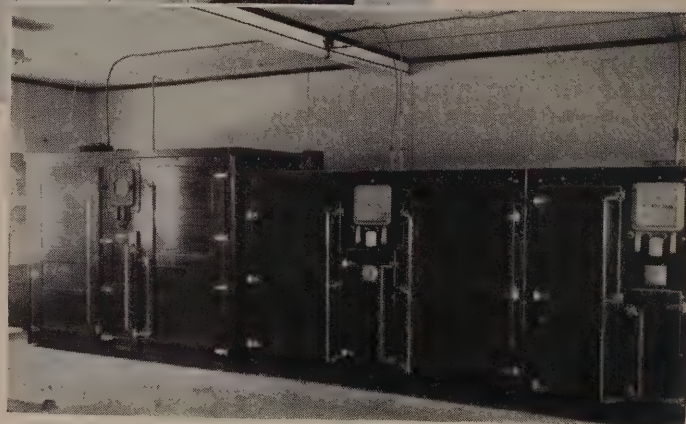
This information indicates that eggs held under excellent conditions hatch reasonably well up to 14 days of age. Few eggs are held under perfect conditions. Therefore, poultrymen should endeavor to ship eggs at least once each week, and twice weekly in extremely hot or cold weather.

If eggs are held too long they tend to make a slow draggy hatch. This is shown in the test below: (all eggs cooled when first collected).

<i>Time held before setting</i>	<i>1 to 7 days</i>	<i>8 to 14 days</i>	<i>15 to 21 days</i>
Time of hatch.....	21 days-8 hrs.	21 days-18 hrs.	22 days-2 hrs.

Incubation

Vast improvements have been made in incubators during the past few



Numerous types of commercial incubation equipment are available to the hatcheryman

years. There are several manufacturers of well constructed and reliable machines.

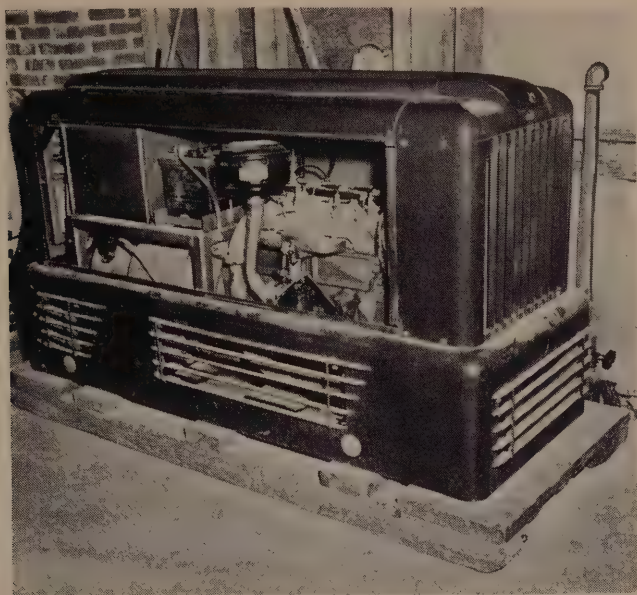
As soon as the hatcheryman purchases his incubator he should carefully study and follow the manufacturers recommendations regarding its operation. Manufacturers of incubators have done a great amount of experimenting to determine the best operating procedures before placing their machines on the market.

* Incubation Trouble-Shooting Chart

SYMPTOMS	PROBABLE CAUSES	SUGGESTIONS
MANY CLEAR EGGS SHOWING NO DEVELOPMENT OR INFERTILES	1. Too many or too few males	1. Use 1 male to 15 to 25 females with Leghorns and 1 male to 12 to 20 females with heavy breeds. Use 1 male to 10 to 12 females for turkeys.
	2. Seasonal decline in fertility in late summer and fall	2. Use early hatched cockerels 6 to 9 months of age depending on rate of sexual maturity.
	3. Males undernourished as evidenced by poor fleshing and shrink of comb and wattles	3. Replace underweight males with vigorous males in good condition. Provide feeders on roosts. Dub Leghorn males.
	4. Interference of males during mating	4. Do not use too many males. Raise males together. Provide temporary partitions or blinds in large pens when breeders are confined.
	5. Frozen comb and wattles during cold weather	5. Provide comfortable housing and use proper kind of drinking fountains. Dub males in cold climates.
	6. Males too old	6. Use cockerels instead of old males unless the latter are proved valuable breeders.
	7. Preferential mating — in pen matings	7. Artificially inseminate infertile hens or put with another male in different pen.
	8. Sterility of males — usually in pen mating	8. Replace with another male.
	9. Eggs held too long. Eggs chilled by holding at too low a temperature	9. Set eggs within 7 to 10 days after laying. Hold eggs where the temperature is between 40° F. and 60° F.
BLOOD RINGS	10. Improper temperature	10. Check accuracy of thermometer. Check thermostat, heating element, current supply; check operating temperature against manufacturer's instructions.
	11. Improper fumigation	11. Do not fumigate at high concentrations during the first 5 days of incubation.
	12. Holding eggs at temperatures above 80° F. before incubation. Weakening embryos by chilling	12. Hatching eggs should be held where the temperature is below 80° F. preferably below 60° F., and above 40° F.

MANY DEAD GERMS	13. Temperature too high or low 14. Improper turning of eggs 15. Breeding (low hatchability inherited) 16. Improper ventilation — insufficient oxygen 17. Pullorum disease or other salmonellosis	13. See suggestions (10) above. 14. Turn at least 3 times, preferably 5 or more in 24 hours. 15. Avoid close inbreeding. 16. Increase ventilation of incubator and incubator rooms; avoid drafts. Add oxygen at high altitudes. 17. Use eggs from disease-free sources only.
PIPPED EGGS NOT HATCHING	18. Insufficient moisture	18. Increase evaporating surface for moisture or increase sprays. Chickens: first 18 days, wet-bulb: 85°-87° F.; 3-day hatching period, 90°-92° F. Turkeys: first 24 days wet-bulb: 87°-88° F.; 4-day hatching period, 92° F.
HATCHING TOO EARLY HATCHING TOO LATE STICKY HATCH	19. Too high temperature 20. Too low temperature 21. Probably too high temperature	19-21. See (10) above. For all three — check temperature at maximum or when current actually goes off. During hatching period check temperature after current goes off to see if it increases further.
MALFORMED CHICKS SPRADDLERS	22. Temperature too high 23. Too low moisture 24. Improper turning or setting 25. Hatching trays too smooth	22. See (10) above. 23. See (10) above. 24. See (14) above. Set eggs large end up. 25. Use trays with wire or crinoline on bottom.
ABNORMAL CHICKS Weak chicks Small chicks	26. Overheating in hatching unit 27. Small eggs 28. Insufficient moisture	26. See (10) above. 27. Set only standard or larger size eggs. 28. See (18) above.
LABORED BREATHING	29. Too much fumigant, respiratory disease (bronchitis or Newcastle)	29. Check with nearest disease laboratory.
LARGE, SOFT-BODIES, MUSHY CHICKS, DEAD ON TRAYS, BAD ODOR	30. Low average temperature 31. Poor ventilation 32. Navel infection (omphalitis) in incubator	30. See (10) above. 31. See (16) above. 32. Carefully clean and fumigate incubator between hatches.
ROUGH NAVELS	33. High temperature or wide temperature variations	33. See (10) above.
HATCHING TOO LATE OR NOT UNIFORMLY	34. Old eggs and eggs of different ages	34. Set eggs at least once each week.

* From the book *Fertility and Hatchability of Chicken and Turkey Eggs* (Prepared by W. M. Insko, Jr., J. E. Parker, E. M. Funk, and W. R. Hinshaw, edited by Lewis W. Taylor.)



In case of electrical failure an auxiliary power plant can save hatching losses

The following fundamentals regarding incubation may be helpful:

1. Operate machines in well insulated rooms where sudden temperature changes may be avoided. There seems to be a trend toward operating the newer force-draft machines in houses built above ground, as contrasted with the older type sectional machine being operated in the basement.



Sorting for quality chicks

2. Use properly controlled ventilation, allowing a plentiful supply of fresh air. Auxiliary heat should be available so that a room temperature close to 70° F. may be constantly maintained.
3. Construct walls and floors to allow for proper sanitation, avoiding cracks, corners, and crevices which are difficult to clean and disinfect.
4. Do not operate the incubator in the same building with chicks or older birds because of the danger of disease. A building well apart from where poultry is kept is preferred.
5. Immediately remove all accumulated refuse following all hatches.
6. If the machine is of the cabinet type with the incubating and hatching trays all in one compartment, remove from the remaining eggs all down from the chicks recently hatched. A vacuum cleaner is of great help.

Thoroughly clean and disinfect trays and removable equipment after each hatch. The steam jenny is a good tool for this job. See fumigation recommendations in chapter, **POULTRY HEALTH**.

A knowledge of embryo mortality, time of hatching, and conditions of chicks at hatching time often aids in locating the cause of troubles. Chart on pages 115 and 116 gives suggested remedies for the most common causes of poor hatches.

Poultry Meat

POULTRY meat production has become a highly specialized enterprise and a leading source of income in the poultry industry. Broiler production has expanded rapidly and is concentrated in some areas. Development of specialized meat strains, hardy stock, erection of modern dressing plants, specialized feeds, modern transportation, and consumer demand have all contributed to make poultry meat production an efficient and separate phase of the poultry business.

This chapter is chiefly concerned with specialized poultry meat production. Certain factors to be mentioned, however, may well be applied to the efficient marketing of fowl and help to increase the income of the egg producer.

Factors Affecting Cost of Production

Factors affecting the cost of producing poultry meat are within certain limits under the control of the individual poultryman. The efficiency of his production will determine to a large extent whether or not he can produce poultry meat at a profit. There are certain accepted practices that affect the cost of production. It is essential that these practices be carefully followed in order to insure best results.

Strains and Crosses for Meat Production

Broiler contests have shown that different breeds, strains and crosses vary widely in meat characteristics and in their ability to convert feed efficiently. There is a definite trend among producers of poultry meat to purchase chicks which have been bred especially for meat production. Considerable progress has been made among breeders to produce a chick that will have desirable meat characteristics when ready for market. Some producers are using a meat type New Hampshire, a meat type White Plymouth Rock, or a meat type Barred Plymouth Rock; while others are using crosses of two unrelated breeds such as meat type Barred Plymouth Rock male x meat type New Hampshire female, or Dominant White male x meat

type New Hampshire female or meat type Barred Plymouth Rock female. There are several other crosses that have localized popularity. The grower should base his particular choice on the strain or cross that is in greatest demand in his area.



Modern 2 story house with central heat and flue type ventilators

Rate and Uniformity of Growth

A rapid rate of growth is necessary for profitable broiler production. Select only those breeds and strains that have been bred primarily for meat.

The breeder and the broiler raiser alike want birds that can be marketed at any given age and have the desired rate and uniformity of growth, good fleshing, and finish. A wide variation in condition, weight and appearance does not lend itself to merchandising or premium prices.

Feathering

Fast feathering is essential to good market quality. Pin feathers do not add to the ease of dressing and detract from the finished appearance of the carcass.

Breeds with white feathers, or straight New Hampshires with a light under-color, are generally preferred when sold as New York dressed or eviscerated. Birds kept to heavy, roaster size and sold alive have sold equally well if they were barred crosses, sex linked pullets or straight Barred Plymouth Rocks.

Resistance to Disease

The health of any given flock may determine the difference between profit and loss on a broiler operation.

The broiler grower should always buy his stock from sources that are Pullorum Clean or Pullorum Passed.

Chickens hatched from flocks which are immunized for Newcastle and



Future poultry meat

Bronchitis possess an immunity to those diseases for the first few days of their life. This is vital in some areas.

Feed Efficiency

Strains as well as breeds of birds vary widely with respect to their ability to convert feed into meat.

Feed Efficiency Chart

Lbs. of Feed per Lb. of Gain	Lbs. of Meat per 100 lbs. of Feed	Added Weight Per		Value of Extra Weight per Ton of Feed When Chickens are Selling for 25¢, 30¢ and 35¢ per lb. (live wgt.)		
		100 lbs. of Feed	Ton of Feed			
				25¢	30¢	35¢
3.5	28.5714					
3.4	29.4118	.8404	16.808	\$4.20	\$5.04	\$5.88
3.3	30.3030	.8912	17.824	4.46	5.35	6.24
3.2	31.2500	.9470	18.940	4.74	5.68	6.63
3.1	32.2581	1.0081	20.162	5.04	6.05	7.06
3.0	33.3333	1.0752	21.504	5.38	6.45	7.53
2.9	34.4827	1.1494	22.988	5.75	6.90	8.05
2.8	35.7143	1.2316	24.632	6.16	7.39	8.62
2.7	37.0370	1.3227	26.454	6.61	7.94	9.26
2.6	38.4615	1.4245	28.490	7.12	8.55	9.97

For Example:
If feed efficiency improved from 3.2 to 3.0, the value of the extra meat (chicken worth 25¢ per lb.) would be \$5.04 + \$5.38, or \$10.42 per ton of feed.

Specialized feeds of the low fibre, high energy type have made worthwhile contributions to the poultry industry. Much less feed is required to produce a pound of gain than with the old type rations.

The preceding chart shows the value of feed efficiency as measured by the pounds of chicken meat per 100 pounds of feed and the value of the extra weight per ton of feed.

Housing

The trend in poultry houses used for meat production has been to larger units. These larger units provide greater efficiency of labor; better use of



Two story broiler house

labor saving devices, such as central heat, automatic waterers, mechanical feeders, elevators, etc.; and lower construction cost per bird.

Types of Buildings

A few factors that must be considered in the type of building to be used to produce poultry meat are as follows: possibility of remodeling existing buildings, new construction, single or multiple story, equal or two-thirds span or shed-type roof and the cost and availability of lumber, or cinder blocks. The trend is toward large, deep houses, with equal span or shed-type roof.

Foundation and Floors

Concrete foundations, constructed as posts or walls that go below the frost line, are most commonly used. Buildings of the combination "brooder house and shelter" type may be constructed with the foundation above the frost line. Sand or gravel floors are often used to reduce construction costs. In most locations, either wood or cement floors are recommended.

Ceiling and Walls

Walls should be built to eliminate a harbor for rats and mice. Insulating material applied to the outside of the studs or boarding rather than the inside of the studs has proved satisfactory.



One story broiler house,
40' x 250'

Broiler house, 620' x 44',
showing flue ventilation and
wide doors



Wide type house, 44' x 120',
with 20' grain room, showing
equal span roof

Broiler house, 44' x 100'
with 15' grain room



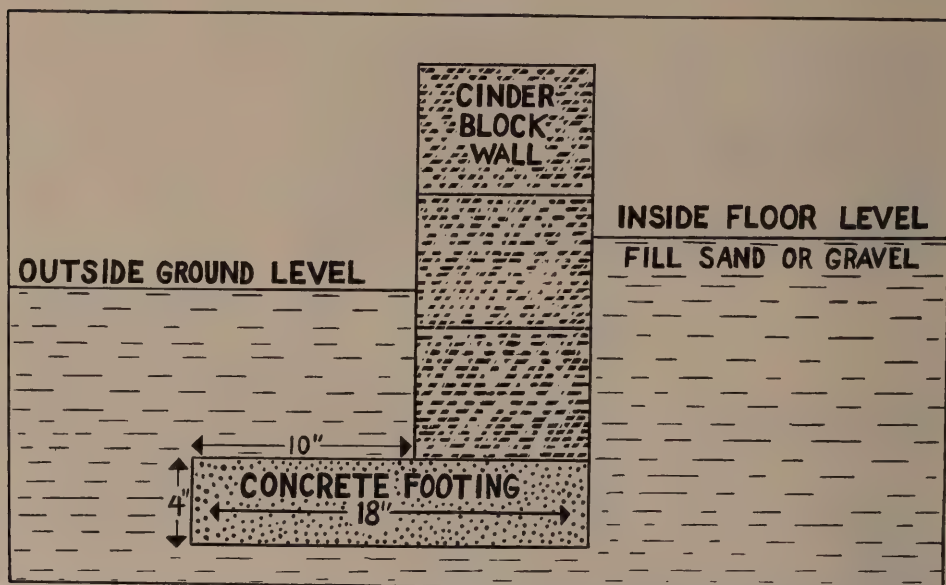
The ceiling should be high enough to allow the operator to move about the pens with ample head clearance. Remember to make allowance for the addition of litter, overhead supporting timbers and electrical fixtures.

Insulation

Well insulated buildings help to lower fuel and feed costs. Insulation serves a dual purpose in keeping the houses warmer in winter and cooler in summer. It lessens the problem of maintaining good ventilation and litter condition.

Ventilation

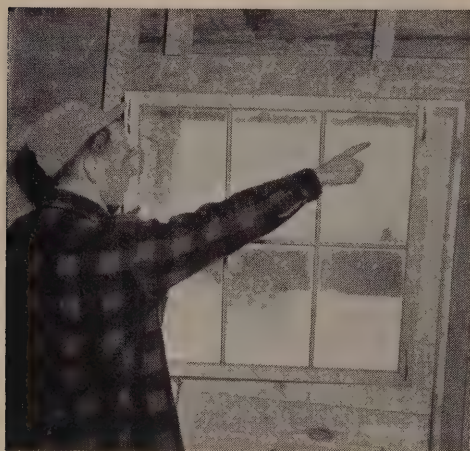
Adequate ventilation is essential in the production of poultry meat. The



Rat Proof Cinder Block Foundation Construction. Footing should be eighteen inches wide with cinder blocks set back on the inner side of footing to prevent rats from going under the foundation

movement of air in a broiler house is very necessary from the standpoint of maintaining flock health and good litter conditions. In general, through-

out the northeast, windows and flues are satisfactory means of ventilating.



Window showing steel spring clips to hold it tight against frame

Windows

Windows should come to or near the ceiling or plate to allow the warm humid air to escape. One square foot of window space to 25 square feet of floor space has proven adequate in broiler houses.

Flues

The rule poultrymen use in putting in ventilating flues is to allow one-half to one square inch of ventilating flue area to each square

foot of floor area, depending on climatic conditions. A ventilating flue should not be less than 16 inches square (inside measure) or its equivalent.

Brooding Equipment

The choice of heating equipment for brooding meat birds is affected by several factors. One must consider climate, housing, labor efficiency, in-

stallation costs, operating costs, and types of heat. While the long accepted practice has been to heat a restricted area on the floor for the chicks, recent years have seen the introduction of equipment which heats an entire room.

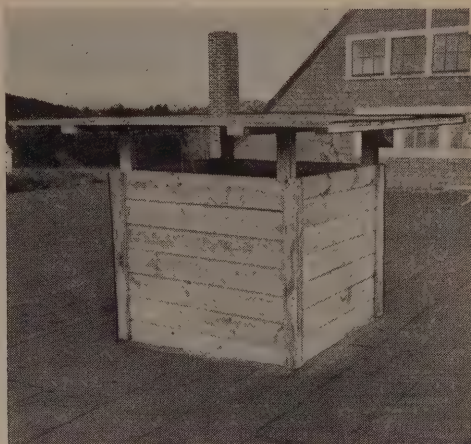
Among all types of heating equipment, coal burning stoves continue to hold their popularity. They are especially suited to cold weather brooding, as they give the extra heat needed to maintain a desirable room temperature. The stove may be set on bricks, or a cement block four to six inches high. Several coal stoves may be piped into one chimney. When openings into a chimney are on opposite sides, they should be offset and not opposite each other. Consult your insurance agent before installing other than brick chimneys.

Less labor is required in operating gas and electric brooder stoves.

They are especially adapted to warm weather brooding. One brooder stove may be used for each 500 chicks. Gas brooder stoves are hung on pulleys and elevated as the birds increase in size. The stoves should be located near the rear of the building, and the edge of the hover should be at least 5 to 6 feet away from the nearest wall. That amount of space will help prevent birds from feeling any cold that penetrates the wall in winter, and also give them room to move away from the stove if it becomes overheated. When the hover is set too near a wall, escape for the birds is impossible, and it is also difficult to work around the stoves. These same factors should be borne in mind when setting up stoves in a line. Allow six to eight feet between the edges of the hovers.

Units using infra-red bulbs are also being used. In a house having 50° F. room temperature, a 250 watt bulb supplies sufficient heat for 75 chickens.

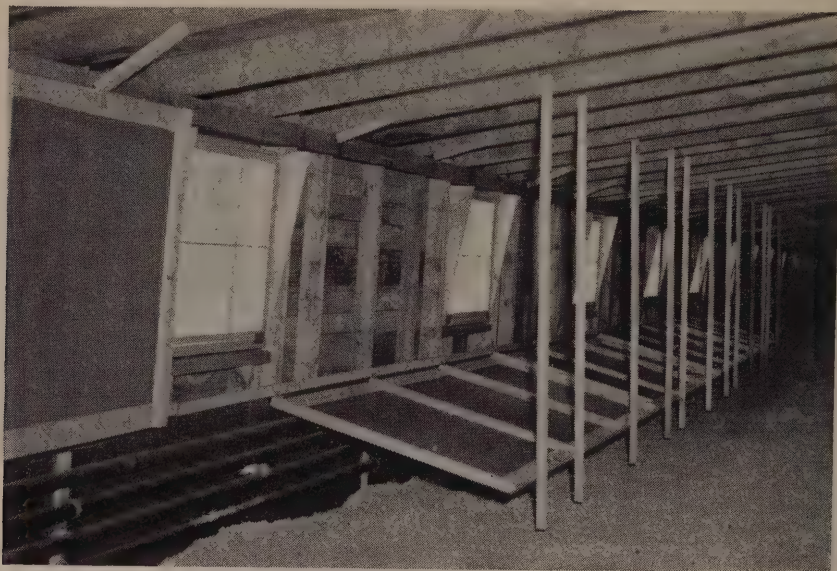
Brooding systems using a central heating plant are increasing in popularity. They are of two types: either hot water or hot air. Although the hot water systems are comparatively expensive to install, they are easy and economical to operate. The usual set-up consists of the furnace and cir-



Flue-type ventilator



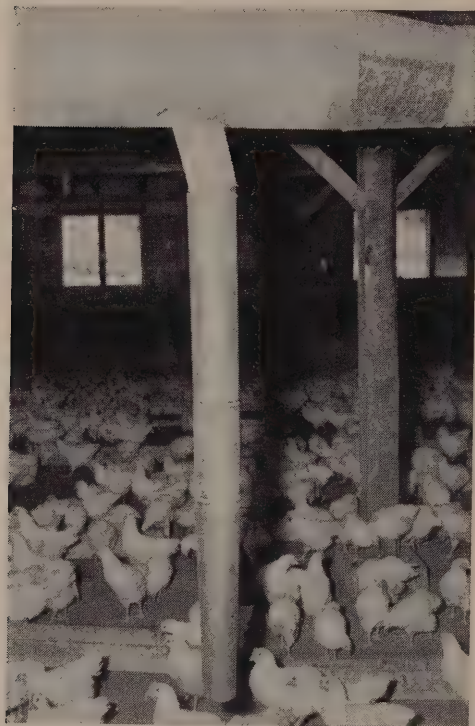
Ventilator flue between floors



Hot water brooding showing coils on wall and canopy

culating pump, plus a series of parallel pipes placed either horizontally 12 to 14 inches above the floor or one above the other against the rear wall. Where piped hot water systems are used, insulating material should be

placed on top of the pipes to hold the heat down on the chickens. If used against a wall, a hinged hover suspended from the wall should be used. In cold weather the litter under pipes in a horizontal set-up should be built up to within 6 to 10 inches of the pipes.



Hot air brooding system

One of the most common hot air systems uses a large duct or trunk line running out from the furnace, with smaller pipes branching off and extending down to within 18 inches of the floor. Heated air is pushed through the pipes by a thermostatically controlled fan. One branch pipe serves approximately 500 chickens. This type of heat requires an insulated building for most satisfactory results. Accumulated dust should be removed from the air chamber of a hot air furnace after each brood. When

setting up any heating system follow the recommendations of the manufacturer.

The use of unit space heaters, such as those used in auditoriums and garages, is a new method of brooding. With these heaters, the entire room is maintained at brooding temperatures. Individual hot water heated units using a fan to push the heated air are either suspended from the ceiling or hung from a frame. These units are heated by either gas or oil. Here again, a well insulated building will give more economical and satisfactory results.



Hot air brooding unit with canopy

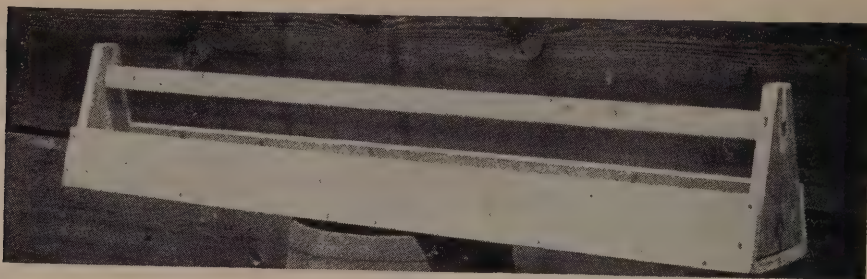
Most central heating systems depend on electricity. An auxiliary generating unit is good insurance against power failure.

Brooder Guards

During the first few days of brooding, baby chicks do not recognize the source of heat, and tend to wander away. Brooder guards made of cardboard or inch mesh wire covered with bags should be placed within two or three feet of the hover edge. As soon as the chicks have learned where the



Cut down chick boxes may be used as feeders for young chicks



Broiler feeder for use after chicks are four weeks old

source of heat is, the area inside the guards may be gradually increased. By the end of a week they may be completely removed, if weather conditions are favorable.

Feed Hoppers

The practice of using two sized feed hoppers for birds up to roaster size is generally accepted. The chicks may be fed on papers or in small chick-size hoppers for the first week. Many poultrymen have had satisfactory results from the use of chick boxes for feed hoppers for the first two to three weeks. The sides are cut down so that the chicks can easily get in and out, and the partitions are removed. If gas or electric brooders are used, feed should be put under the hover for the first few days. If hoppers are placed with one end toward the center of the hover, as in spokes on a wheel, the chicks will be better able to move toward or away from the heat. By the time the birds



Broilers feeding from mechanical feeder. Insert shows a mechanical feeder with a guard. Guard has been raised to show chain which conveys feed



are three weeks old, they may use large sized hoppers. Types of hoppers having high sides should be settled down into the litter at first so that the feed is readily accessible to the birds.

By the time the birds are six weeks old 3 four-foot hoppers or their equivalent should be provided for every hundred birds. Feed wastage is kept at a minimum if the hoppers are never filled more than half full, and the birds are allowed to empty them once a day. Adjustable reels on the hoppers are also helpful in keeping feed wastage down. Metal feed hoppers are practical and easy to keep clean. Feed carriers speed hand feeding on many farms. Mechanical feeders, when used in a meat bird operation, make it possible for one man to care for a larger number of birds than would ordinarily be possible. Where it is not possible to allow one foot of feeder space for every 12 to 15 birds, hoppers should be used in addition to mechanical feeders to provide additional feeding space.

Waterers

A good supply of clean water is a must on the poultry farm. Waterers are a collecting place for molds and slime, and should be cleaned daily. This will encourage birds to drink more and make faster gains, as a quart of water is consumed for every pound of feed eaten.

To start the chicks, one gallon-size waterer per 100 chicks is recommended. They should be evenly spaced around the brooder so that all chicks will learn to drink. As soon as possible, automatic waterers should be set up, as chicks may be taught to use them within two weeks. They



Automatic waterer, a great labor saver

provide a considerable saving in labor. The change-over to automatics should be gradual. This is accomplished by moving the gallon waterers a few feet nearer the automatics each day. Gallon waterers can be entirely removed after the chicks have become accustomed to the automatic fountains.

There are several satisfactory types of automatic waterers, consisting of automatic valves and trough or pan type containers. Where a good supply of water and good drainage is available, a continuous flow, gutter-type waterer is practical. Allow 3 four-foot troughs or pan-type waterers per 1000 birds, or more if necessary, to give equal distribution. Place waterers low enough for accessibility but high enough to keep chicks from scratching debris into them.



Automatic waterer on wire platform helps to maintain sanitation

During periods of disease or intense summer heat, when birds show little inclination to move about, extra pans placed around the pen will aid in maintaining adequate water consumption.

Management Practices

The number of birds that one man can care for depends upon the buildings used, the amount of labor saving equipment, the method of marketing, and the amount of available extra labor for cleaning and miscellaneous jobs. It is practical for one man to take care of between 5000 and 15,000 broilers. The number of lots of birds raised in a year depends, of course, on

the age to which each lot is grown, and the amount of time devoted to cleaning out between lots. Time allowed for proper airing out and cleaning of buildings should be included as a regular part of the work schedule.

The Brooding Period

Allowing adequate floor space for each bird raised will more than compensate the grower for marketing a smaller number of birds. Extra room, better air and litter condition, less competition at the feed hopper, all add up to more money from fewer birds. One square foot per bird up to eleven weeks, and one and one-quarter to one and one-half square feet for roasters have been shown to give satisfactory results. When birds are raised in a limited space, the many problems of management are more acute.

In raising birds for broilers or roasters, it is essential that all birds in each lot be of the same age. When there is as little as four days difference in ages at the start, the younger birds do not grow as well, and often appear to be two weeks behind the older birds at market time.

Some poultrymen may have a marketing system which demands that several age groups be raised at all times. Such a situation greatly aggravates the disease control program. It will be helpful in such cases to raise each lot as far from the others as possible. Pet bantams or small family

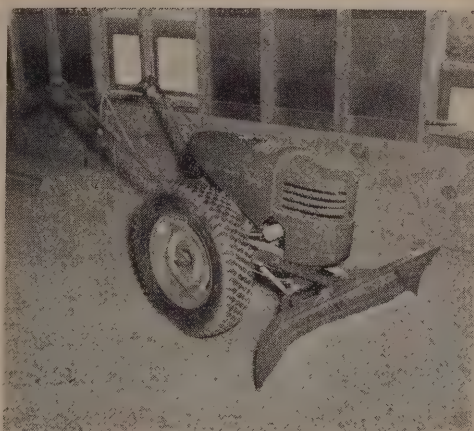
flocks of layers kept on the premises are a constant threat of infection to growing birds.

Litter

Several satisfactory types of litter have been used. Sawdust and shavings may be available and economical in one region, but impractical in another area where ground corn cobs or sugar cane fiber are meeting the need. Absorbency of the litter is important. If green sawdust or other



Float type waterer showing piping arrangement to facilitate adjusting the height of the waterer



Small tractors aid in cleaning out old litter

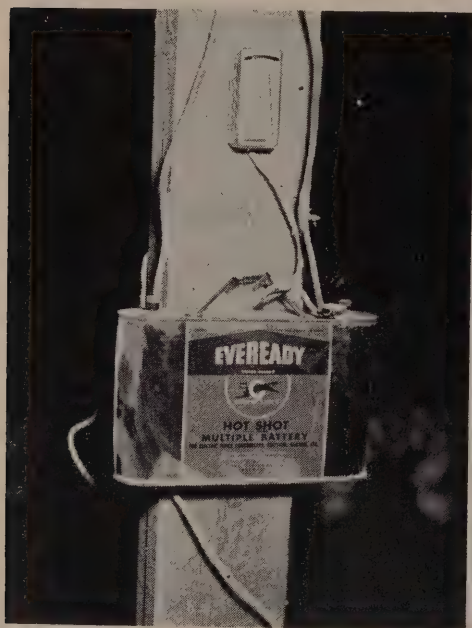
wet litter must be used, it may be put into the brooder house a few days early, and dried considerably by the heat of the stoves before the chicks arrive. Put litter in to a depth of from two to six inches. Thorough cleaning and a change of litter is recommended after each lot of birds.

It is common practice during the first few days to place a layer of newspaper over the litter inside the brooder guard.

Temperature and Humidity

Baby chicks are very sensitive to changes in temperature during the first week of life. Overheating or chilling may result in pasting up, high mortality, or general unthriftiness. To be sure that proper room temperature can be maintained, and that the stove or heating system is working properly, fires should be lighted two to three days before the chicks arrive. Where coal stoves or hot air units are used, the litter may get too dry, in which case it may be necessary to sprinkle water periodically around stoves, and on the litter to prevent dehydration of the chicks. After the chicks reach two weeks of age, there may be sufficient moisture from the droppings to take care of excessive dryness.

Proper temperature for the first week of brooding is 90° F. at a point 2 inches off the floor at the edge of the hover. Each week thereafter the temperature may be lowered approximately 5° F. depending on outside weather conditions. Chick behavior is the best guide as to proper temperature. Bunching and crowding at the source of heat indicates too low temperatures, or drafts. Excessive heat will cause chicks to pant and crowd against the brooder guards. Floor drafts should be avoided where possible. Brooder guards and double entryways to pens are useful tools to keep drafts off baby chicks.



Simple alarm system for central heating systems is supplied by thermostat, hot shot battery, and bell connected in series

Some heat is necessary throughout the entire rearing period during the winter months in northern regions. Proper room temperature will aid in keeping good litter conditions. Extra heat is

helpful during periods of respiratory troubles or other diseases.

Lighting

A 7½ watt bulb directly over each stove, or under the hover, is used to attract chicks to the source of heat, and to make it possible for them to drink at the fountains during the night. Additional lights should be used during the winter months, as a means of lengthening the daylight feeding period. A fourteen hour day is generally adequate for growing birds. During periods of extremely hot weather all-night lights or early morning lights may be used to keep feed intake normal.

Feeding Program

For broiler, roaster or capon production, Wirthmore Improved Hi-Ener-G Starter and Broiler Ration is recommended. It is formulated to satisfy all nutritive requirements for rapid and efficient broiler growth under a wide variety of plant conditions. This feed is available in either mash or pellet form.

In addition, Wirthmore Plus-2M Broiler Feed has been offered to supply the demand in certain areas for a broiler ration with even a lower fiber content than the Improved Hi-Ener-G ration. It is also available in mash or pellet form and should be fed according to the Wirthmore Improved Hi-Ener-G feeding instructions.



A bucket type elevator is a convenient method of getting feed to upper floors

Coccidiosis Prevention

Coccidiosis in broiler flocks has been a major hazard in the production of meat birds. The coccidiostatic drugs, when used properly at preventive levels, have been shown effective for the prevention of excessive mortality and weight loss associated with coccidiosis.

Initially a level of .0125% was used. More recently, and based on extensive experimental work and field trials, drug levels of .0175% to .025% have been shown to be more effective in suppressing coccidia than .0125%. A more complete suppression of coccidiosis has been shown to result in faster gains, heavier market weights, more uniform flocks and better feed efficiency.

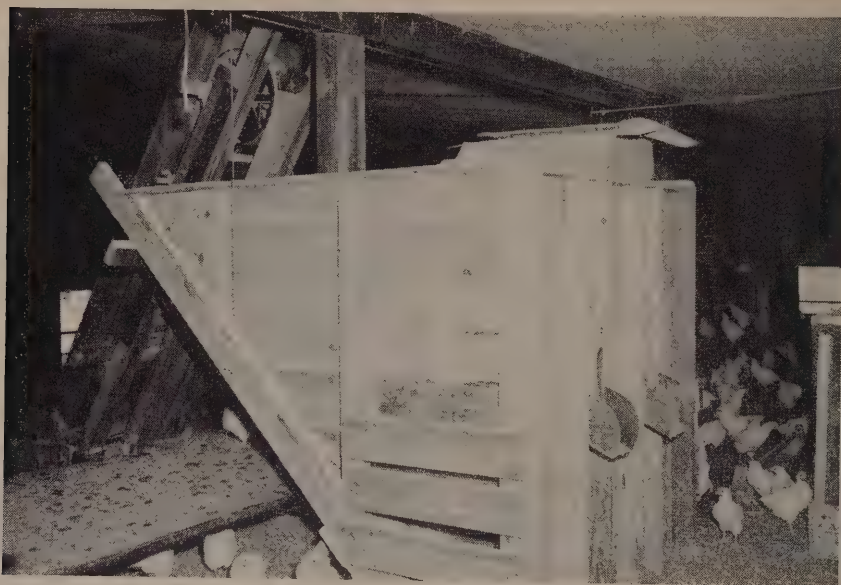
From the standpoints of effectiveness as a coccidiostat, ability to be properly dispersed in the feed, and returns over the cost of its addition, a level of .0175% sulfaquinoxaline has been found to be of unquestionable value

as an aid in the prevention of coccidiosis. In addition, when the higher drug levels are used, Wirthmore Fattening Pellets may be fed liberally with the medicated mash from eight weeks of age to marketing. Even when one bag of Wirthmore Fattening Pellets is fed with each two bags of the mash medicated at the .0175% or higher level, the drug intake constitutes an effective aid against late infections of coccidiosis.

A mixture medicated with .1% sulfaquinoxaline is also available for use during outbreaks. Feeding directions are printed on the back of all medicated feed tags. For further information on coccidiosis and its prevention refer to chapter, **POULTRY HEALTH**.

Broilers

Keep Wirthmore Improved Hi-Ener-G in mash form before broiler chicks from start to finish. When the chicks are two weeks old, begin to



Feed storage bin at the end of a feed elevator

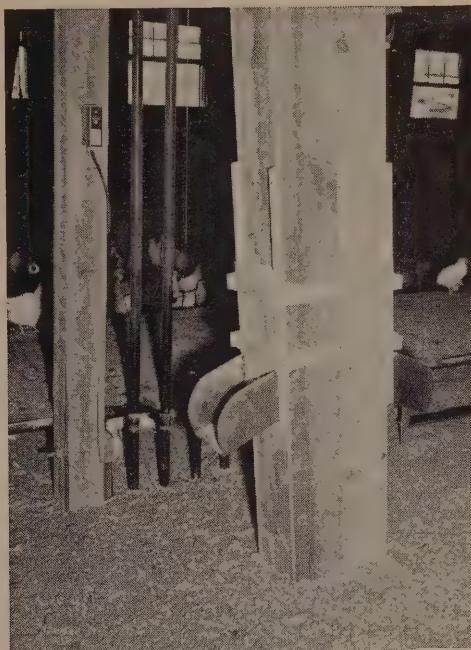
feed pellets once daily on top of the mash in each hopper. Do this until the birds are eight weeks old, giving as many pellets as they will eat in 15 to 20 minutes, or about one bag of pellets to four bags of mash. At eight weeks, change from the regular pellets to Wirthmore Fattening Pellets, but continue to feed the regular broiler mash. After making this change, increase the quantity of pellets fed as rapidly as possible so that the proportion from eight weeks to marketing will be one bag of pellets for each two bags of mash. This rate of feeding Wirthmore Fattening Pellets gives broilers high quality finish, maintains rapid gains, and reduces feed cost at the time broilers eat most heavily. These starting feeds are so formu-

lated as to allow the poultryman to use a larger amount of these effective finishing pellets, without slowing down or lowering feed conversion. In addition, this mash and pellet system of feeding promotes better feathering, quieter birds, and more even weights than does the 100% use of pellets for two or three weeks before marketing, as shown by tests under broiler plant conditions.

Roasters

How Improved Hi-Ener-G Ration or Plus-2M Broiler Feed is used to greatest advantage for roasters and capons depends, first, on whether they are to be kept in confinement or raised on range, and, secondly, on whether or not their breeding and management favors making the desired market weight quickly. In any case, for the first eight weeks follow the directions given for broilers and then adopt the feeding practice suggested here that fits the conditions of the flock in question.

Roasters grown in confinement, if bred and managed to reach market weight in 12 to 14 weeks, should be fed Wirthmore Fattening Pellets



Chute from feed storage bin to lower floors



Range shelter showing adjustable side

daily, along with the broiler mash after they are eight weeks old, using one bag of pellets with each two bags of mash. Slower growing birds can be fed hard grain in addition to the mash and pellets, starting at 10 weeks with a limited amount and increasing at 12 weeks to a maximum equal to 25% of the total daily feed. The schedule then would be one of grain, one of fattening pellets and two of mash.

Range reared roasters seldom reach marketable conditions and weight as quickly as those grown in confinement. For this reason, hard grain feeding with the mash and fattening pellets after the 10th week is recommended. The mash and pellets may be kept before the birds in hoppers, but the grain should be restricted by hand feeding daily an amount not in excess of one-third total feed consumed.

Capons

Capons are of two kinds; one being permanently unsexed by castrating cockerels at an early age, whereas the other is produced at a later age by

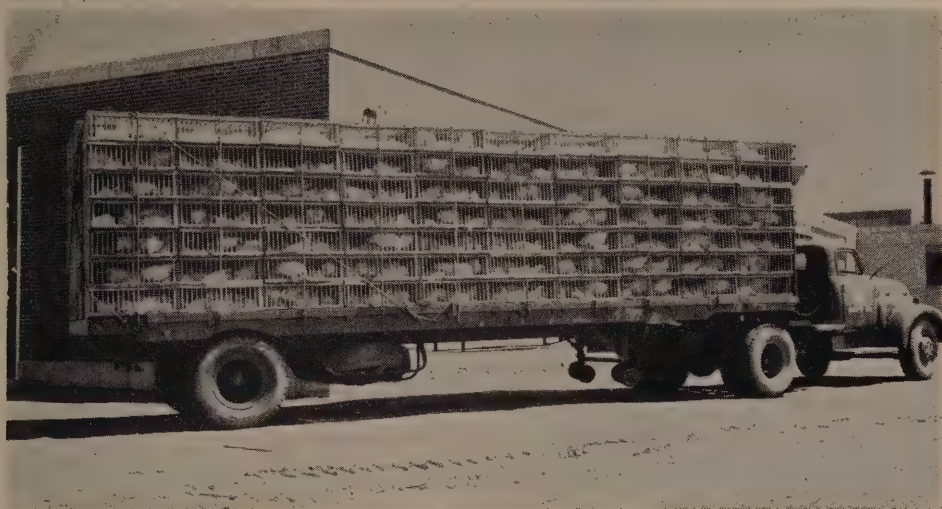


Summer shelter for broilers

implanting a pellet containing a hormone that suppresses male characteristics. The latter are commonly called capettes, caponettes or hormonized fryers. The two types have different feed requirements. True capons must be fed much longer to be marketable than is the case with hormone induced capons. Caponized cockerels should be fed the same as broilers until eight weeks old, and thereafter as recommended for range reared roasters, although their mash can be changed to Wirthmore Growing Mash at 10 weeks, particularly when they are to be grown to heavy weights. Capons produced by hormone implanting are usually grown rapidly and marketed usually at 13 to 15 weeks of age. Whether grown in confinement or on range, a feeding program suited to their requirements is the same as that given for slower growing roasters in confinement.

Marketing of Poultry Meat

Marketing of poultry meat is an important factor in the poultryman's business. With improvements in dressing, packaging, transportation, and market reporting, the poultryman finds that it is to his advantage



A load of live poultry direct from farm

to familiarize himself with all aspects of the business. The egg producer sells his fowl as a by-product of his major enterprise. However, he has discovered that top market prices are paid for full feathered birds which he can obtain by debeaking or by specking. He finds that extremely fat fowl bring less price per pound than well meated light weight fowl. It is to his advantage to have birds free from lice and mites, which cause unsightly blemishes on the skin. As marketing time draws near meat producers should check daily U.S.D.A. price quotations, and at the same time contact their local poultry buyer. Contacting poultry buyers slightly ahead of the time the poultryman actually wishes to sell often prevents delays in selling.

Marketing Broilers, Fryers and Roasters

The poultryman producing meat is confronted with the problem of how to make the most out of his selling. With increasing demand by consumers for a quality product the meat producer should make every effort to produce a quality bird which demands a top market price. As the time to sell approaches, meat producers usually weigh a few coops of birds to get a sample weight of the flock. They then apply this weight against their cost, which in turn gives them a basis to figure at what age their birds will market at the greatest profit.

It seems advisable to market when a reasonable profit can be seen, rather than to wait, looking for a higher price which may never come.



A modern poultry farm sales room

The marketing of broilers, fryers and roasters on a commercial basis has become a highly specialized business and involves the following steps:

1. A study of U.S.D.A. market report for the particular market where birds will be sold.
2. Contact local poultry dealers and discuss with them the market trends.
3. Complete all arrangements with the buyer such as method of weighing, whether birds will be picked up at farm or delivered to the plant, etc.

Shrinkage in weight between the time birds are picked up and weighed is a factor each poultryman should consider. Arrange your buildings so that a minimum amount of time and labor is used in loading the birds from the building to the truck. If temperatures are high, either a temporary shade should be provided, or trucks should be loaded on shady side of building. In many cases, during severe hot weather, poultrymen prefer to load the birds at night. Feed and water are given as usual until the birds are loaded. In order to reduce bruising of birds, many poultrymen remove feeders during the time the birds are being loaded.

Meat producers as well as egg producers are becoming conscious of diseases and parasites which can be transported to their farms by means of poultry coops. Some poultrymen insist on the coops being disinfected, while others set up a staging area some distance from their farm. They load and haul the birds in their own coops to this area, and transfer to the buyers' coops. This prevents the spread of disease but it represents an extra labor cost and possible shrinkage of weight.

Marketing Fowl

Marketing fowl is similar to the marketing of broilers, fryers and roasters as previously discussed. However, the deciding factor in marketing fowl may be either price, rate of lay, or replacement program. In the past poultrymen have held for a high holiday market; however, due to the rapid growth of the poultry meat industry, holiday markets are not showing the past high peaks. This in turn has led many poultrymen to sell their fowl when production is no longer profitable, rather than feed them for a long period and gamble on a higher market.

Producer to Consumer Marketing

Poultrymen who are located close to heavily populated areas find that they can supplement their income by dressing and retailing their own birds. Anyone interested in setting up a small dressing plant should contact their state inspectors for specific instructions on sanitation.

Killing and Bleeding Operations

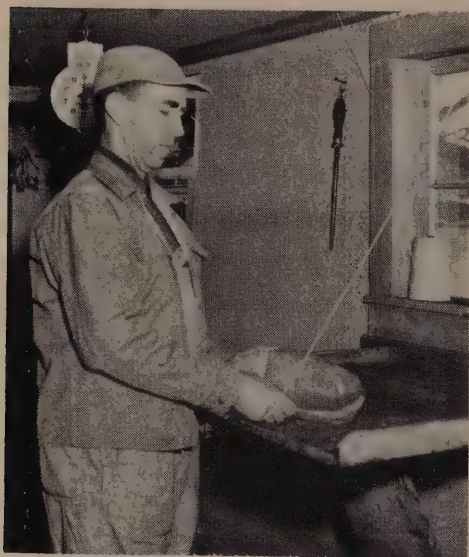
The birds are hung up either with a cord around the legs, having a wooden two inch button at the end, or by putting the legs in regular shackles or



A farm dressing room

by placing the body in a funnel. The head is held in the hollow of the left hand by the thumb and forefinger, and the middle finger is used to hold the mouth open. The jugular vein is cut to bleed the bird by putting a

narrow knife blade into the mouth and cutting at the junction of the veins, with a downward stroke to the right. Do not grasp around the neck as this will prevent the blood from flowing freely. After cutting the vein, the third or rear lobe of the brain, located at the base of the skull, is



Packaged for market

pierced with the point of the knife. This is done by thrusting the knife into the cleft or groove in the roof of the mouth, with the back of the blade held parallel to and close to the underside of the upper beak. If done properly the bird will squawk. The knife then should be given a quick quarter turn to damage more brain tissue. This causes the feather muscles to relax, which is helpful if the birds are to be dry-picked. Otherwise, it is not necessary to debrain as semi-scalding will loosen the feathers. A weighted blood can is then hooked to the lower beak and picking started immediately. The weighted blood can tends to hold

the head steady. Another method of bleeding is to cut the throat from the outside, close to the head.

Removal of Feathers

Dry-Picking Method: A satisfactory job of dry-picking can be done only when the rear lobe of the brain is properly pierced, causing the feather muscles to relax so that the feathers will become loose. The feathers are grasped in handfuls and removed by an up and outward rolling motion of the hand. The feathers should be removed rather rapidly, but without marring the skin or flesh, so that only a comparatively few are left before the muscles reset. Any remaining feathers are removed and the necessary pinning is done. The entire carcass should be picked clean.

Semi-Scalding to Remove Feathers: Semi-scalding is far superior to hot scalding. It loosens the feathers without injuring or cooking the outer skin of the bird, provided the water temperatures are correct, and the operation is done properly. Temperatures range from 125° F. to 132° F. Scalding tanks equipped with thermostatically controlled heating units are the best for this purpose. Some dressers use a regular wash boiler as a scalding tank, and the water is heated by placing the tank on an oil stove. The water is held at approximately the desired temperature by adjusting the flame, and adding hot or cold water if necessary. Scalding



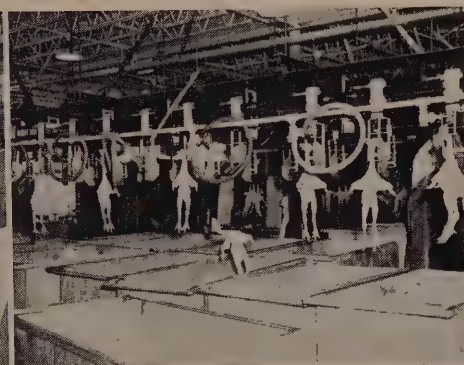
A modern poultry dressing plant



Station feeding room



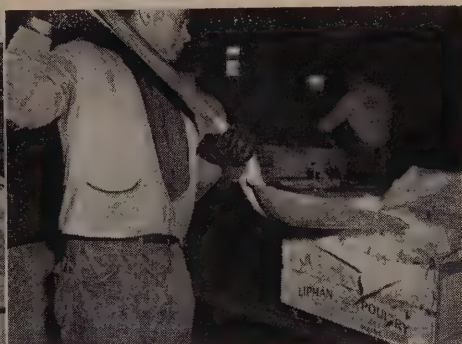
Production line efficiency



Automatic scales sort birds by weight



Body heat is removed in tanks of ice and water



Icing before shipment



Eviscerating dressed poultry



Wrapping eviscerated birds

tanks should be large enough to hold a sufficient volume of water so that the water temperature is not too easily reduced by the cooler body temperature of the birds.

After the birds are thoroughly bled, they are immersed for a definite length of time in water heated to a given temperature. The recommended temperatures and lengths of time are: Broilers — 125° F. to 128° F. for about 30 seconds; roasters, capons and fowl — 128° F. to 132° F. for about 30 seconds. When picking machines are used the birds are not immersed in water quite as long as when hand-picked. It is advisable to keep the birds in motion while immersed so that the water will be well distributed around all of the feather follicles. Water softeners are sometimes used to insure fast penetration of water through the oil of the feathers. Birds to be picked by hand should be hung up at a convenient height for the picker. Plucking birds on a table or bench is liable to result in scuffing the skin.

Mechanical Pickers

Mechanical pickers are widely used in home dressing plants. The same process of bleeding, killing and semi-scalding is used with mechanical pickers as when hand-picked. Care should be taken not to bruise birds with the picker by trying to remove pin feathers.

Cooling Dressed Poultry

There is no part of preparing dressed poultry for market more important than proper handling after killing. As soon as the bird is killed it starts



Storage before shipment

to deteriorate. This process is retarded if the bird is immediately chilled. To chill birds, they should be placed in ice water for not over six hours. If the birds are left in the water for extended periods, the meat becomes soft and loses some of its flavor. After the birds have been properly cooled, they are ready to be packed for shipment. There should be about six inches of crushed ice placed in the bottom of the container, then alternate layers of poultry and ice. Place

one layer of ice on top, and cover the container securely. If the container is lined with paper, it will prevent rapid melting. The bottom of the container should have spaces or holes enough to allow for drainage. If birds are to be held, they should be placed in a cool room, not over 40° F.

Freezing Dressed Poultry

Freezer units are now being used on some farms in connection with the selling of dressed poultry. It is believed, because of the satisfactory results, that these units will increase in popularity. Family freezing units are found in many homes, while other families have taken advantage of commercial freezer-locker plants.

Birds should be fully drawn, the giblets washed and the inside of the carcass rinsed with cold water or wiped clean with a damp cloth. Drain thoroughly.

Broilers may be cut in halves or quarters, the fowl cut into pieces suitable for stewing or fricasseeing. By cutting the birds into pieces they can be wrapped tighter and then so packed as to take up less space in the locker. Roasters are frozen whole. Excessive abdominal fat should be removed and the giblets wrapped in special freezer-locker paper and placed in the body cavity.

Special cellophane bags or special freezer-locker paper should be used for wrapping the poultry in order to prevent dehydration. This is important. The paper should adhere closely to the pieces of chicken, and each package wrapped absolutely tight so as to prevent freezer burn. The cellophane bags can be sealed by placing the two sides of the open end of the bag tightly together and drawing a hot iron across, an inch or so below the edge of the opening. Cut poultry may also be packaged in cartons made especially for holding foods to be frozen.

The pre-cooled packaged birds should be placed at once in the quick freeze compartment of the unit. The freezing can be done quicker if the packages are spread out in single rows so as to permit the cold air to circulate around them freely. After being frozen they may be stacked or piled up.

In some freezer units the temperature is maintained at 0° F. or a little below. Some freezers have available a sharp-freeze temperature of minus 10° F. to minus 20° F. The holding temperature, to be safe, should be at least 0° F. Otherwise, there is some danger of spoilage, particularly when the poultry is to be held for a long time.

Frozen poultry meat should not be allowed to thaw until it is used. Any poultry that is to be held a few days after removal from the locker should be kept at 40° F. or lower.

Tips on Marketing Dressed Poultry

1. Attractive packaging will make the first sale, but superior quality will encourage repeat sales.
2. Meet competition by selling better quality than your competitors.
3. Try to maintain a steady supply.

Tips on Marketing Live Poultry

1. Don't try to outguess the market. When birds have reached the maximum efficient growth, sell.
2. Plan your program to meet market demand.
3. Do everything possible to make the general flock appearance more attractive.
4. Keep posted on market quotations.



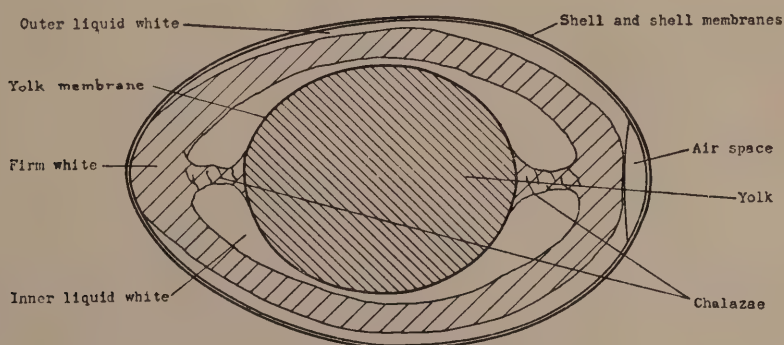
Modern brooding units with good grass range

Market Eggs

THE TREND in modern egg production and merchandising is toward high egg quality. This chapter deals with those factors that affect the production of attractive, uniform, high quality eggs. Three facts face the poultryman: (1) It is impossible, in the light of present knowledge, to improve the interior quality, size, shape, or color of eggs after they are laid. (2) The only way to improve the quality of newly laid eggs in the future is to breed hens that produce quality eggs. (3) Eggs must be handled carefully, if they are to reach the consumer in as good interior condition as when laid. Although the egg is one of nature's most perfect foods, it is a perishable product and its quality must be guarded from the time it is laid until it is consumed. If egg consumption is to be increased in the U. S., egg producers and merchandisers must have satisfied customers — and quality is a key to customer satisfaction.

Producing Quality Eggs

Three things that could affect the quality of eggs before they are laid are: (1) breeding, (2) feeding, and (3) management. The inheritance factor plays an important role in the production of top grade eggs. Therefore, considerable attention should be given to the background of the breeding behind replacement chicks.



The parts of an egg

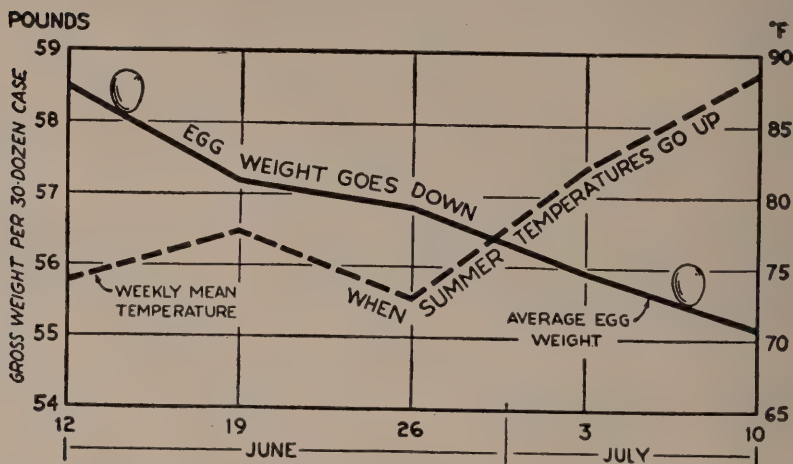
Feed seems to have little effect upon the physical structure of the egg, but it does affect the vitamin and mineral content and the uniformity of yolk color. Therefore, the use of a scientifically balanced commercial ration according to the manufacturer's directions is highly essential in the production of top grade eggs.

Environmental conditions under which the laying flock is kept may also affect the quality of the eggs produced.

The following are undesirable characteristics sometimes found in eggs when first laid, and their causes:

1. *Small Egg Size*

- a. Birds hatched in late fall and early winter.
- b. Continued high environmental temperatures.
- c. Inherited factor.



Egg weight falls off in hot weather. In a test during five summer weeks, all the eggs marketed from 1200 layers (hens and pullets) were weighed and weekly averages computed. When the temperatures advanced from about 73° F. to 80° F. the eggs lost an average of 3½ pounds per case

2. *Irregular Egg Shape*

- a. Respiratory troubles — especially Bronchitis.
- b. Pullets just starting to lay are likely to be erratic in ovulation, hence double yolks are common the first few weeks of laying.
- c. Inherited characteristics.

3. *Poor Shell Quality*

- a. Certain families of birds have a tendency to produce porous shells, rough shells, and weak ends.
- b. Ration low in vitamin D.
- c. Improper mineral balance in ration.
- d. Latter part of laying period.
- e. Respiratory trouble or aftermath of late vaccination.
- f. Abnormal condition of shell glands in uterus.
- g. Periods of high temperature.

4. *Shell Color*

- a. Inherited characteristic
- b. Heavy production over a long period causes color to fade.
- c. Respiratory upsets have a temporary effect. For example, with an outbreak of Newcastle, brown eggs may turn chalk white for a few days and then return to normal as birds recover.

5. *Albumen Quality* (Causes of thin, watery albumen)

- a. Inherited — Is a trait of individual hens and sometimes a family weakness.
- b. High temperature
- c. Latter part of laying period
- d. Respiratory diseases

6. *Lack of Uniformity of Yolk Color*

- a. Largely a dietary problem — access to feeds with dark vegetable pigments tend to produce dark yolk color. Complete rations produce uniform yolk color.



Misshaped eggs and loss of shell texture due to an acute attack of infectious bronchitis in the flock

7. *Egg Odors*

- a. Fishy odors are generally traced to individual birds.
- b. Strong vegetables, such as onions, garlic, etc.
- c. Eggs held near objectionable materials may absorb odors.

8. *Blood and Meat Spots* (Both of blood origin)

- a. Originate during formation of yolk — caused by a rupture or leakage of small blood vessels in the follicle which surrounds the growing egg yolk. Ruptures may occur when yolk is released from follicle.
- b. Meat spots are blood spots which have been transformed by chemical actions of the body.
- c. Inherited factor.

Maintaining Egg Quality

The quality of an egg cannot be improved after it is laid. Poor handling and subjecting the egg to undesirable surroundings can reduce its value to a low grade product. Proper egg handling is the responsibility of the



The Mass. Clean Egg Nest is easy to build and will help produce quality eggs. A tray filled with lime for a nesting perch will keep down the number of dirty eggs, if litter becomes wet

farm operator as long as the egg remains on the farm. The experience of the poultryman, market distance, transportation methods, and climatic conditions make it understandable as to why there is a wide variation in the quality of eggs received from these farms.



Egg washers, when properly operated, will not affect egg quality and will save time. Dirty eggs are shown entering washer at top center; clean eggs are coming out at lower left. Notice the convenient location of the grader at right which enables cleaning and grading to be done at the same time

The main factors responsible for the loss of egg quality at the farm are as follows: (1) General lack of knowledge of how to maintain egg quality. (2) Lack of proper facilities for handling and holding eggs. (3) Failure to move eggs to market promptly.

The following eight points should be observed if eggs are to be handled properly:

1. Insure cleanliness of eggs in laying quarters.
2. Gather eggs at least three times daily.
3. Cool eggs quickly.
4. Maintain a temperature of 45°–60° F. in the egg holding room.
5. Pre-cool and moisture-condition egg cases, flats and fillers before using.
6. Maintain a relative humidity of 70%–75% in the egg holding room.
7. Pack eggs daily.
8. Market eggs at least twice weekly.



Eggs, if not too dirty, can be cleaned with an abrasive, on-hand egg cleaner

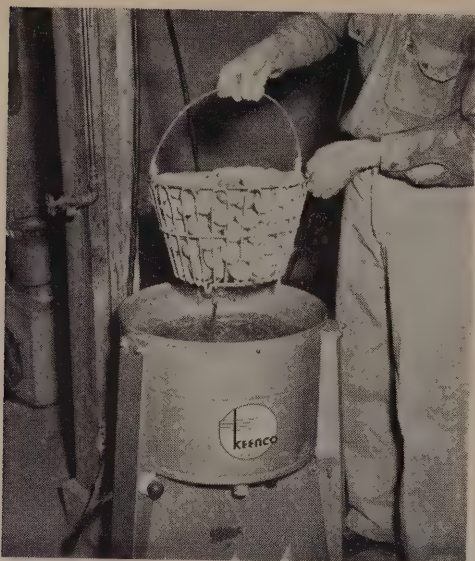
Produce Clean Eggs

It is estimated that from 5% to 15% of all eggs need to be cleaned. Every effort should be made to produce clean eggs and only clean eggs should be marketed.

Good management can reduce the number of dirty eggs. Rules to follow are:

1. Adequate nesting space — one square foot of community nesting space or one individual nest to every five or six birds.
2. An adequate amount of clean nesting material — four to five inches of fine absorbent nesting material is sufficient.
3. A nest perch consisting of a tray filled with finely ground lime, either hydrated or finely ground limestone, or lime put on the litter in front of the nests.
4. Wire over pits to prevent birds from coming in contact with droppings.
5. Elimination of wet spots in pens.
6. House birds before they begin laying or use nests on range or in growing quarters of the same type as those in the laying house. This will help prevent floor laying.

Eggs may be cleaned by hand if they are not too dirty. The common practice is to brush the dirty material off with a pad of emery cloth or other suitable abrasive. Stained and dirty eggs need to be cleaned with a commercial cleaner or washed in water. Some poultrymen use the New Jersey method of washing eggs. The eggs are collected in wire baskets. A con-



Cleaning eggs with a detergent by the New Jersey method

tainer is filled with enough warm water at a temperature of 140° to 160° F. to cover a basket of eggs. Add a teaspoon of detergent (Dreft, Vel or similar product) to each gallon of water. Then dip the basket of dirty eggs into the solution, remove, allow to drain and repeat the process. Hose off the loosened dirt with hot water by spraying all sides of the basket. A cone in the center of the basket will make the washing job more complete. For best results when washing eggs the practices listed below should be followed:

1. Wash dirty eggs the day they are laid.
2. Use clean water at a temperature at least 15 degrees higher than that of the egg.
3. Wash eggs so that the dirty water passes off. Don't let eggs stay in the water.
4. Dry eggs quickly.
5. When using a commercial egg washer, directions of the manufacturer should be followed carefully.

Gather Eggs at Least Three Times Daily

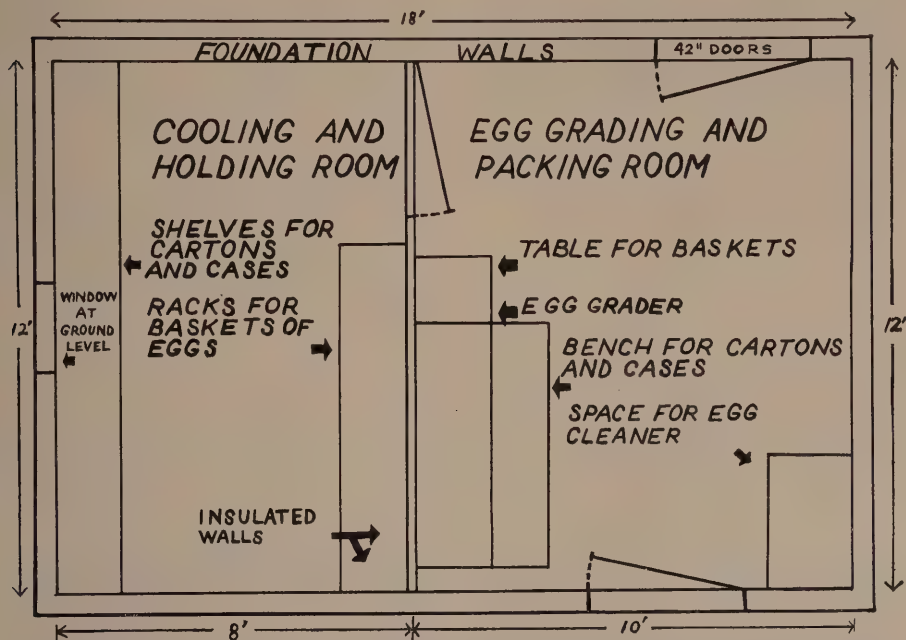
The clever operator will gather eggs often to guard against heated or frozen eggs. Breakage is also cut down if this practice is followed. The temperature of an egg when laid is above 100° F. and other hens may maintain this level for several hours if eggs are not gathered often. Deterioration may set in and lower the egg quality.



Wire baskets allow eggs to cool more rapidly than containers with solid sides

Cool Eggs Quickly

Eggs should be taken to the holding room as soon as possible after collecting. Collections should be made in wire baskets. This allows circulation and cooling much sooner than in closed containers. A heavy wire basket should be used to withstand the lifting, as some baskets will spring inward when lifted and crush outside eggs. In the holding room the eggs should be left in the baskets until thoroughly cooled. Eggs that are packed when warm will lose quality rapidly.

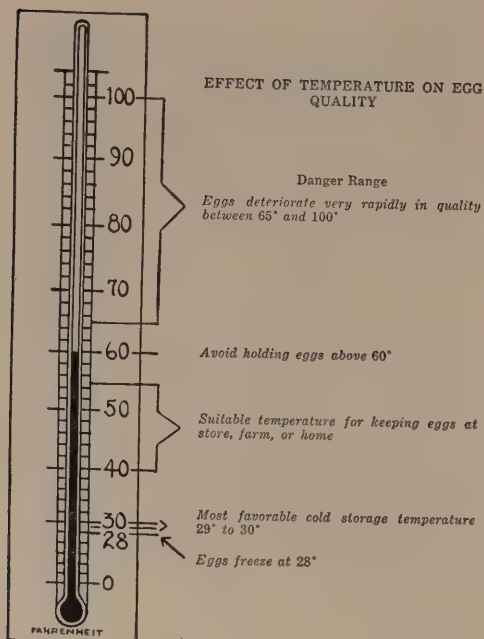


Suggested plan for a convenient two-room egg cellar. Size will vary with volume of eggs handled. For 2500-3000 hens the holding room should be 8x12 feet and the grading room 10x12 feet

A Good Egg Holding Room

A basement is ideal for an egg room. It is easier to maintain proper humidity and temperature under the ground level. If the egg room is located above the ground, insulation is necessary to maintain proper temperature and humidity. When locating the egg room thought should be given to centralization and the ease of carrying out eggs and loading trucks for market. Some method of providing ventilation by using windows, fans or flues is advisable, and it may be necessary to provide extra moisture by means of mechanical humidifiers or perforated water pipes running next to the foundation wall.

The egg room should be large enough to hold a day's collection of eggs, 5 days' supply of eggs in cases, and 5 days' supply of empty cases. Unless a separate room is provided for egg grading and packing, the room should



also be large enough so that these operations can be easily and efficiently carried out.

On commercial poultry farms it is best to have a two-section egg cellar: one room for cooling and storing eggs with three sides against the foundation and the fourth made of double insulation board; the other room (adjacent to the holding room) for cleaning, grading and packing and equipped with a heating unit. This allows the eggs to be kept under cool conditions while the operator, who spends many hours grading, can work in a more comfortable room.

Egg Room Temperature

Maintain a temperature of 45° F. to 60° F. in the egg room. For all practical purposes this temperature level is sufficiently low to maintain egg quality and discourage mold growth. This temperature will prevent germ development which starts at 69° F. Temperatures of less than 45° F. are not recommended because of the difficulty of maintaining satisfactory humidity. Eggs held at low temperatures will sweat when brought into a warmer atmosphere.



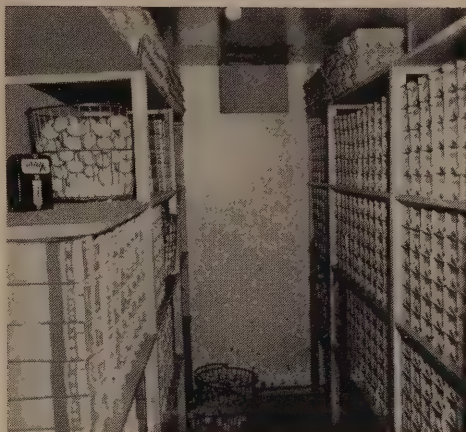
Egg cooling and holding room equipped with mechanical humidifier

Egg Room Humidity

Relative humidity of 70%–75% in the egg room is probably one of the most important factors in maintaining interior egg quality. A higher humidity is not necessary when proper temperatures are maintained. Humidity may be maintained in the egg room by wetting the floor or part of the walls, or by commercial humidifiers especially designed for this purpose.

Preparing Egg Cases, Flats and Fillers for Use

Empty egg cases, flats and fillers should be pre-cooled and moisture conditioned before packing eggs in them. This can be done by putting the empty cases into a room with a low temperature and high humidity at least one day before they are to be used. Only clean cases, flats and fillers should be used and the main supply of cases should be kept in a clean dry place to prevent the formation of molds. Make sure that egg cases are in good repair and that flats and fillers are sound before using them.



An egg cooling and holding room for the retailer. Note shelves to hold cartoned eggs, also ventilator flue in ceiling and humidity and temperature recorder at left



Egg carriers reduce the poultryman's work load

Pack Eggs Daily

Eggs should be packed daily after the animal heat has been removed. A good practice is to place eggs gathered today in the cooling room and pack them tomorrow. Pack eggs with the small end down. This keeps the air cell centered in the large end of the egg so that quality may be better maintained during the shipping and handling process. If eggs are packed with the large end down tremulous air cells will develop during the handling process.

Plan to Market Eggs Twice Weekly

It is important that eggs go to market at least twice a week to insure top market grades. A quality product is essential to continued sales. One of



The commercial egg grader is a labor saver for the poultryman

the best ways to maintain egg quality is to get the eggs to the consumer as soon as possible.

In most cases, loss of egg quality is greater on the farm than in any other part of the marketing process. The following results were obtained when eggs were held at room temperatures of 58 degrees and 70 degrees for periods of 4 and 7 days before shipment:

- 7 days at 70° F. — graded 20% Specials
- 7 days at 58° F. — graded 68% Specials
- 4 days at 70° F. — graded 74% Specials
- 4 days at 58° F. — graded 95% Specials

Consumer Requirements

Consumers demand a uniform product today. In order to continue the desire for eggs and increase consumption, it is necessary to maintain uniformity of quality. Egg standards are based on exterior and interior qualities. With most poultrymen, grading eggs as to size is an accepted responsibility. On large poultry farms automatic electrically powered egg grading machines are often used. The smaller poultry farms may use individual egg scales. These scales may also be used to check the accuracy of automatic egg graders.

Grading Eggs for Exterior Quality

Poultrymen are usually more familiar with how eggs look on the outside than they are with their interior qualities. The consumer prefers uniform clean eggs. It is the attractiveness of the product that helps her make up her mind to buy. Careful attention should be given to the grading and packing of eggs both for wholesale and retail trade. The following items should be checked:

1. SIZE: The U. S. Standards for grading eggs are as follows:

<i>Size or Weight</i>	<i>Minimum Net Weight Per Dozen (ounces)</i>	<i>Minimum Net Weight Per 30 Dozen (pounds)</i>	<i>Minimum Weight for Individual Eggs at Rate per Dozen (ounces)</i>
Jumbo.....	30	56	29
Extra Large.....	27	50½	26
Large.....	24	45	23
Medium.....	21	39½	20
Small.....	18	34	17
Peewee.....	15	28	15

The consumer prefers a uniform pack. Large eggs should be packed 24 ounces to the dozen with no eggs less than 23 ounces per dozen. In packing for retail customers, there should not be too much variation between the size of individual eggs in one package.

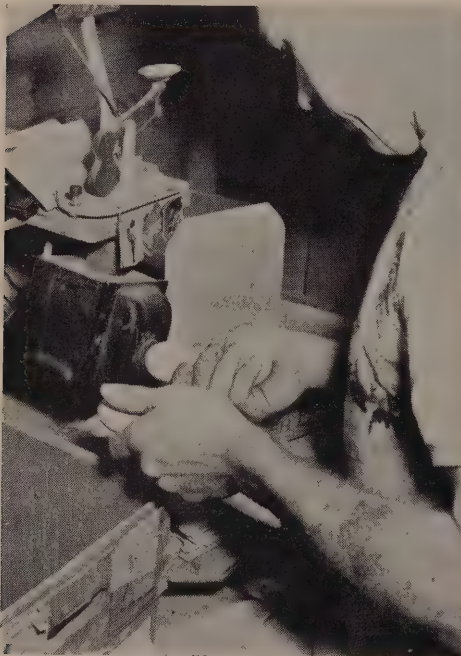
- 2. SHELL: The egg shell should be strong, with a smooth texture and free from conspicuous irregularities.
- 3. SHAPE: Again, uniformity is an important factor to consider in the packaging of eggs for consumers. Extremes should be avoided in the eggs selected for one carton.
- 4. SHELL COLOR: Uniformity in shell color with a certain type of trade pays dividends to the poultryman who is willing to be a little particular in the packaging of eggs.
- 5. SHELL CLEANLINESS: No eggs should be packed unless they are free from all foreign material. Clean eggs should be produced in order to avoid the necessity of washing or scraping.

Each state has an egg law and a definite set of standards for grading eggs. The producer should be familiar with these standards and the egg law for



Mechanical egg grader run by electricity with candling attachment is available for the retail poultryman. Note the individual egg scales at the left of the grader which should be used occasionally to check the mechanical grader for accuracy.

his own state and should follow them accordingly. Copies of this material may be obtained from the Department of Agriculture in each state.



A close-up of an egg candler at work

Determining Interior Quality

Interior quality is determined by candling, a process which makes the interior contents of the egg visible by means of light rays. Most candling is done by the large marketing organizations. However, poultrymen who retail their eggs or sell to stores or small wholesalers should candle their eggs. This is necessary because some newly laid eggs contain blood and meat spots and if delivered to the consumer will hurt the reputation of the poultryman. There are several types of candler on the market. To become an experienced and efficient candler one must receive considerable training

and experience. The determination of interior quality is based on the following factors:

1. **AIR CELL:** The air cell normally develops at the large end of the egg between the two shell membranes. In eggs of best quality, the air cell is small, not over

one-eighth of an inch in depth. This depth should be measured from the end of the shell to the bottom of the air cell space at the point of greatest separation of the membranes. The air cell should occupy a fixed position. Large air cells are an indication of poor quality.

2. **YOLK:** The yolk of a fresh egg should be visible only as a shadow when the egg is turned before a candle. It should have limited freedom of motion. Rapid motion and greater visibility of the yolk indicates lower quality. When the egg is broken into a dish, the yolk of a fresh egg is well rounded and "stands" up, while the yolk of an egg of lower quality is flatter and spread out. The color of the yolk may vary all the way from a pale to a deep yellow. The amount of carotene, chlorophyll, and xanthophyll in poultry rations affects the intensity of yolk color. Green feeds which contain these substances in large amounts will produce dark colored yolks. Such yolks are not desirable especially in white shelled eggs where they cast a dark shadow when eggs are candled and throw them into a lower grade. Uniformity of yolk color is affected by the hen's preference for certain hard grains. The highest degree of yolk color uniformity can be maintained by using the complete ration system of feeding.
3. **WHITE:** The white of an egg should be firm, clear and free from blood and meat spots.
4. **GERM:** The germ in a fresh egg should show no visible development before the candle. When fertile eggs are exposed to a temperature of 69°



Top to bottom: U. S. Special, U. S. Extra, U. S. Trade

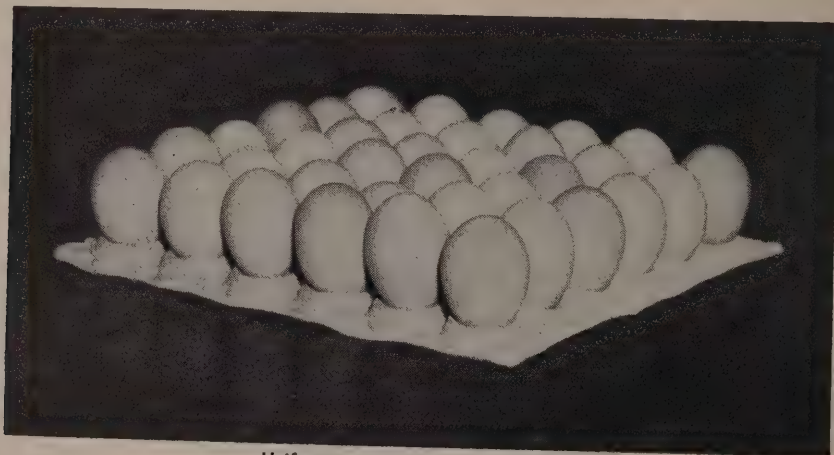
F. or over, the development of the germ will proceed and the size of the spot may reach one third of an inch in diameter before any blood is observed. The development of the germ spot, before the blood ring is formed, affects the quality adversely in proportion to such development. When blood due to germ development shows, the egg is no longer considered edible.



Men at work in a commercial egg candling plant

Methods of Marketing Eggs

The methods of getting eggs from the producer to the consumer are varied. The care, handling, and promptness associated with each method have a decided effect upon the quality of the eggs, upon the satisfaction which they afford the consumer, and consequently upon the price generally paid to the producer. A small percentage of the eggs are marketed directly by the producer to the consumer and a slightly larger percentage goes directly to retail stores, restaurants, and other consumer outlets. The bulk of the eggs marketed go through wholesale distributors and cooperative marketing associations that have grading and holding facilities. Most of these marketing agencies maintain a farm pick-up service which operates at



Uniform eggs appeal to the customer



An attractive sales stand with plenty of room to park and suitable signs is a requisite for a successful roadside business

regular intervals and assures the prompt movement of eggs from the farm.

Each poultryman must work out a marketing procedure that best fits his location and personality. Poultrymen living near large towns or cities may find it profitable to establish a retail business. On well-travelled highways neat, attractive sales stands with ample parking space and suitable display signs help to make a successful retail outlet for eggs and poultry. Colorful, attractive egg cartons which feature the farm name and address and contain a quality product will help to develop repeat business and increase sales. It also pays to advertise on retail route trucks. Some people



Attractive egg cartons which feature the farm name and address and contain a quality product will help to develop repeat business

are not adapted to retail selling and feel that their time can be put to better advantage in the production end of the business. Such people sell to wholesalers and usually operate a larger volume business. In rural areas wholesale marketing is the common practice.

Advertising Eggs

The growth of the poultry industry in recent years has made it necessary to stimulate consumer demand. New England poultrymen with the help of allied industries established the New England Poultry and Egg Institute which led to the formation of a national advertising organization called the Poultry and Egg National Board. These organizations, as well as others, have actively publicized poultry products through public meetings, schools, radio, newspapers, folders and leaflets. From a competitive standpoint this type of activity should be well supported by the poultrymen and by associated poultry interests.

In advertising, one should not overlook the fact that the egg in itself is nearly a complete food. It contains all the necessary elements to nourish life — proteins, fats, vitamins, and minerals. The protein is of high quality and highly digestible. Egg fat is readily digestible and valuable for adults and especially young children. Eggs from properly fed hens contain practically all the essential vitamins except vitamin C. Eggs contain reasonable amounts of calcium, phosphorous, iron, copper, and iodine in available forms. One large egg contains approximately 80 calories. The average egg is composed of 65% water, 13.5% protein, 10.5% fat and 11% minerals (including the shell). It is one of nature's most concentrated products.



Delivery truck and farm store with suitable identification

Poultry Health

In the preparation of material for this chapter of the eleventh edition of "Timely Topics" we gratefully acknowledge the assistance rendered by Dr. E. F. Waller, Department of Animal and Poultry Industry, University of Delaware, Newark, Delaware.

Introduction

The mortality encountered and tolerated by the poultry industry today is the greatest wastage of a major food item in American agriculture. Additional losses from internal and external parasites, lowered egg production, loss of flesh, stunting from infectious diseases and improper management are nearly as great as that arising from the death losses. A considerable proportion of this could be prevented by the application of information and approved practices now available. Additional research is needed before some of the other problems can be prevented or controlled.

Very few people outside of the poultry industry realize the amount of and importance of the poultry mortality problem in this country. As of January 1, 1951 there were 428,475,000 layers on our farms. The mortality for the year 1950 was about 18.5 percent. If this mortality continued through 1951 we would lose about 80,000,000 of these hens with a market value of about \$115,000,000. If the mortality found in broilers, turkeys and other types of poultry is added to that of our pullets and hens, the total will be in excess of \$250,000,000. Less than 1 percent of this sum is being spent on poultry disease research by state and federal institutions today.

The industry has undergone a period of phenomenal growth in the past 20 years. This expansion has been in the size of the flocks for the most part rather than in the number of flocks. There has been a tendency on the part of some poultrymen to rely more and more on medicinal agents and vaccines instead of upon breeding, management, feeding and sanitation. In the broiler industry it is not unusual for the grower to spend a sum of money for drugs and vaccines that is equal to 5 to 7 percent of his feed bill.

If a poultryman is to have a healthy flock he must start with healthy chickens from a well-bred, well-fed and disease-free flock. It has often been stated that there never was and never will be such a thing as a bargain chick. The poultryman will get just as good a bird as he is willing to pay for.

In this section of "Timely Topics" we will discuss some of the more common conditions that are responsible for this continuous drain on the industry and make some suggestions for their prevention and control.

When a disease appears on a farm the first step in bringing it under control is the establishment of a correct diagnosis. For some diseases such as lice, round worms or caecal coccidiosis, an examination on the farm may be sufficient and treatment started immediately. However, if there is any doubt at all about the diagnosis birds should be submitted to your state diagnostic laboratory where a more careful and thorough check can be made by a poultry pathologist.

Different diseases may have the same initial symptoms during the early stages of the outbreak and a complete laboratory examination may be necessary before they can be differentiated. This is especially true of the respiratory diseases. When it is necessary to resort to blood tests or chick embryo inoculation in order to identify the disease it may take several days before the diagnosis is complete.

The following is a list of the northeastern and middle Atlantic state supported laboratories that do diagnostic work for the poultrymen of the area:

State Diagnostic Laboratories

MAINE

Dr. J. F. Witter, Animal Pathologist
College of Agriculture
University of Maine, Orono, Maine

RHODE ISLAND

Department of Animal Pathology
Rhode Island State College
Kingston, Rhode Island

NEW HAMPSHIRE

Poultry Pathology Laboratory
University of New Hampshire
Durham, New Hampshire

CONNECTICUT

Department of Animal Diseases
University of Connecticut
Storrs, Connecticut

VERMONT

Department of Animal Pathology
College of Agriculture
University of Vermont, Burlington, Vt.

NEW YORK

Dr. Saul Narotsky
Poultry Disease Laboratory
East Aurora, New York

MASSACHUSETTS

Department of Veterinary Science
University of Massachusetts
Amherst, Massachusetts

Poultry Disease Laboratory
Massachusetts Agricultural Experiment
Station, Waltham, Massachusetts

Dr. P. P. Levine
New York State Veterinary College
Ithaca, New York

Dr. Walter S. Packer
6 Country Club Road
Oneonta, New York

Dr. C. I. Angstrom
88-90 Prince Street
Kingston, New York
Dr. K. F. Hilbert
Poultry Disease Laboratory
Farmingdale, Long Island, New York
Dr. Ellsworth Dougherty, 3rd.
Duck Disease Research Laboratory
Eastport, Long Island, New York

NEW JERSEY

Department of Poultry Husbandry
State University of New Jersey
New Brunswick, New Jersey
Department of Poultry Husbandry
(branch lab.) Vineland, New Jersey

PENNSYLVANIA

Bureau of Animal Industry
Summerdale, Pennsylvania

DELAWARE

Poultry Disease Control Laboratory
State Board of Agriculture
Dover, Delaware
Branch — Poultry Disease Control Lab.
University of Delaware Substation
Georgetown, Delaware

MARYLAND

Dr. I. M. Moulthrop
Live Stock Sanitary Service
Quantico Road
Salisbury, Maryland
Dr. F. George Sperling
L.S.S.S., 130 N. Bond St.
Bel Air, Maryland
Dr. W. R. Teeter
L.S.S.S., 101 Summit Ave.
Hagerstown, Maryland
Dr. W. R. Teeter
L.S.S.S., Winchester Hall
Frederick, Maryland
Dr. H. M. DeVolt
L.S.S.S.
College Park, Maryland

OHIO

Pathological Service Laboratory
College of Veterinary Medicine
Ohio State University
Columbus, Ohio

WEST VIRGINIA

Dr. J. E. Hanley
Dept. of Agriculture Laboratory
Charleston, West Virginia
Dr. Norman O. Olson
University of West Virginia
Morgantown, West Virginia

VIRGINIA

Dr. Miles G. Bowles
Regional Diagnostic Laboratory
Accomac, Virginia
Dr. A. E. Hancock
Regional Diagnostic Laboratory
Ivor, Virginia
Dr. M. J. Eggert
Regional Diagnostic Laboratory
Richmond, Virginia
Dr. W. M. Hindman
Regional Diagnostic Laboratory
Wytheville, Virginia
Dr. R. L. Getz
Regional Diagnostic Laboratory
Harrisonburg, Virginia

SOUTH CAROLINA

State Diagnostic Laboratory
Room 413
Calhoun State Office Building
Columbia, South Carolina

GEORGIA

Georgia Poultry Laboratory
Gainesville, Georgia
Veterinary Division
Department of Agriculture
Atlanta 3, Georgia
Coastal Plain Experiment Station
Tifton, Georgia

After a definite diagnosis has been made, then a program of eradication or prevention can be outlined. Each disease has a weak point in its cycle of development and that is usually where the attack is started. This may be through vaccination, medication, testing, cleaning, disinfecting, culling, breeding, or complete flock depopulation. It will all depend on the

particular disease that has been found. Causes of the most common diseases are well known; however, there are a few which still need much work and it will not be surprising if additional diseases are encountered as we work on these of unknown cause.

For purposes of description we usually divide diseases into those caused by viruses, bacteria, fungi, protozoa, internal parasites, nutritional, organic, chemical, and unknown. The following is a list of the most common diseases according to the cause:

Viruses

Fowl Pox

Fowl Leucosis

Infectious Bronchitis

Epidemic Tremors

Laryngotracheitis

Chronic Respiratory Disease

Newcastle Disease

Fungus Diseases

Aspergillosis

Thrush or Mycosis of the Crop

Internal Parasites

Common Roundworm

Tape Worms

Caecal Worms

Capillaria

Nutritional

Rickets

Perosis

Crazy Chick Disease

Curled Toe Paralysis

Chemical

Salt

Baking Soda

Burns from Disinfectants

Carbon Monoxide Poisoning

Bacterial Diseases

Pullorum

Fowl Cholera

Fowl Typhoid

Infectious Coryza

Paratyphoid

Tuberculosis

Protozoa

Blackhead

Coccidiosis

External Parasites

Lice

Mites

Bed Bugs

Sand Fleas

Organic

Reproductive Disorders

Peritonitis

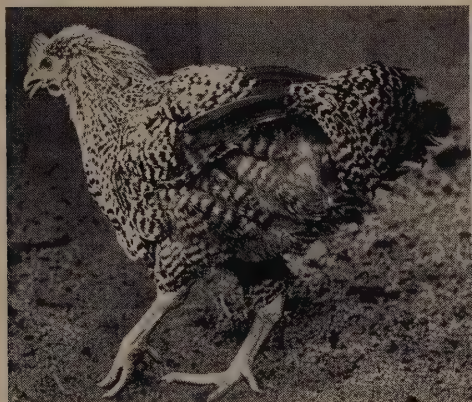
Kidney Disturbances

Unknown

Blue Comb Disease

Enteritis

These various diseases may spread in a number of ways. There is a group that is spread by direct contact. Healthy birds come in contact with those that are infected. Respiratory diseases, fowl pox, cholera, typhoid, and pullorum disease are examples of this. Indirect contact is the term used when infections may be carried from one pen to the other by air currents or on dust particles. Newcastle disease and infectious bronchitis are believed to be carried in this way. There is the carrier problem to contend with. These are birds that have had an infectious disease but have apparently recovered only to still harbor the infection in the body. When these come in contact with susceptible birds, new outbreaks usually occur. Then there is the group of diseases that are spread through contamination of the feed, water, and grit by infective material. Coccidiosis, internal parasites, and blackhead are examples of this. There are also a



Courtesy Lederle Laboratories

Typical paralysis resulting from Newcastle disease

number of diseases that can be transmitted from one point to another through feed bags, visitors, dogs, and rats and possibly some free flying birds.

In submitting specimens to the state diagnostic laboratory care must be taken in selecting the birds to be examined.

1. A minimum of 3 birds should be submitted. These should be birds showing typical symptoms that are observed in this outbreak and not just culled birds from an infected flock.
2. Both sick and dead birds may be submitted if the dead birds have just died. Do not submit birds that have been dead more than 2 or 3 hours.
3. If possible deliver these birds to the laboratory in person. In so doing, pathologists may be able to get a more complete history which is essential for the diagnosis.
4. If these birds cannot be delivered in person, it may be possible to have some messenger who is acquainted with the farm deliver them for you.
5. As a last resort, ship live birds only by railway express. If it is necessary to do this there should be a stamped letter attached to the outside of the package giving a history as complete as possible. A shipment of birds by common carrier to the laboratory should be done only as a last resort since there are likely to be other healthy birds or baby chicks in the same carrier and the disease may spread to them. If it is necessary to submit dead birds to the laboratory during the summertime, they should be well chilled before they are sent. If they are to be shipped by express they should be packed in dry ice or a water-tight container containing ice should be placed in the package. Do not ship packages so that they will be in transit over the weekend or holidays. Such material is worthless and will only delay the diagnosis.

General Sanitary Procedures Helpful in Preventing or Controlling Disease

1. *Incubator Sanitation*—The prevention of disease should start with the incubator. All dirt, dust, etc. should be removed by dry cleaning the incubator, following which it should be fumigated with formaldehyde gas. Fumigation is

particularly important if there has been an outbreak of pullorum disease. The incubator should be housed in a separate building and no chicks should be kept or started in batteries in the same building.

- a. The incubator should be warm and moist with a dry bulb reading of between 99° and 100° F. and the wet bulb reading about 90° F.
- b. Formaldehyde gas is liberated from commercial formalin by potassium permanganate. For each 100 cu. ft. of air space, thirty-five cubic centimeters (1.16 oz.) of formalin for 17.5 grams (6/10 oz.) of potassium permanganate are required. Cornell Extension Bulletin No. 337 suggests the table given below. Use two to three times suggested amounts given in table if attempting to control omphalitis. The stronger doses should not be used if eggs have been in the incubator only 24 to 96 hours; if eggs are pipping; or if chicks are present in the incubator. This concentration of gas is highly effective but would be injurious to chicks during these stages of incubation. The eighteenth day of incubation is the most desirable time for fumigation.

<i>Cubic Feet of Air Space</i>	<i>Amount of Formalin</i>	<i>Amount of Potassium Permanganate</i>
10	1 teaspoonful	$\frac{1}{2}$ teaspoonful
20	2 teaspoonfuls	1 teaspoonful
50	6 teaspoonfuls	3 teaspoonfuls
100	$\frac{1}{4}$ cup	$\frac{1}{8}$ cup
200	$\frac{1}{2}$ cup	$\frac{1}{4}$ cup
400	1 cup	$\frac{1}{2}$ cup

- c. The required amounts having been calculated, the formalin is poured into a non-breakable dish containing the potassium permanganate, large enough to avoid boiling over, and the door quickly closed.
 - d. Fumigation of the incubator while the chicks are hatching may assist in preventing the spread of pullorum disease. Fumigation at this time is not, however, indicated with *Pullorum Clean* eggs, but if used, the standard amounts should be carefully calculated.
 - e. If formaldehyde gas escapes, ammonia water sprinkled around the room will neutralize it and prevent it from becoming obnoxious.
2. Before the chicks arrive make sure the brooder house has been thoroughly cleaned and disinfected and allowed sufficient time for drying and odors to subside. Make sure the brooder is operating properly a couple of days before the arrival of the chicks.
 3. Avoid crowding the chicks in order to help maintain dryness of litter, to prevent piling and vices such as cannibalism.
 4. Use ample clean ground for range (preferably land unused for poultry for at least two years), as this encourages better utilization of forage and less chance for excessive contamination from coccidiosis and internal parasites.
 5. Prevent outside introduction of infections such as from poultry dealer trucks, crates, visitors and returning birds from poultry shows. Never introduce breeding stock in any form except as pullorum passed or clean hatching eggs or chicks.
 6. Dispose of dead birds using a disposal pit or incinerator. Dead carcasses can be the source of serious losses from botulism during the warmer months of the year.
 7. Keep manure from accumulating around the premises. Manure attracts flies that may spread disease. Do not spread poultry manure on land to be used for ranging poultry.

8. Cull frequently to remove sick birds from the flock.
9. Make sure old birds do not come in contact with the young stock. The old flock may be carriers of disease and thus perpetuate the trouble if they have direct contact with the young flock. Remember that a fence between flocks does not constitute a break in contact.
10. Clean and thoroughly disinfect the laying houses after disposal of the old flock and before housing the replacement pullets.
11. House pullets in separate buildings from the old flock (this will continue to break the contact between the old and young flock). Such diseases as infectious coryza, the respiratory form of fowl cholera and others may be eradicated from farms by following such a program.
12. Destroy rats. They waste feed and serve as mechanical carriers of disease.

Vitamin Deficiencies (Avitaminosis)

Severe vitamin deficiencies are comparatively rare in the poultry industry today. Most cases that are seen are usually secondary to, or associated with, some other condition.

VITAMIN A DEFICIENCY

This vitamin is plentiful in yellow corn, alfalfa leaf meal, some fish oils and green feeds. It is usually considered as quite stable; however, prolonged periods of hot weather or long periods of storage of prepared mashes will cause considerable deterioration of it.

Vitamin A deficiency in the laying flock will cause the birds to be thin, weak, and their feathers to be rough. As the disease progresses, there will be a watery discharge from the eyes and nose and, upon closer examination, yellowish-white pustules will form in the mouth and esophagus. Egg production is decreased and the length of time between clutches will be increased. Hatchability is definitely lowered and chicks hatched from such eggs will be weak and the mortality will be high the first two weeks. If the chicks are hatched from eggs containing a normal amount of vitamin A, but are placed on a vitamin A deficient feed, losses usually do not occur before the 4th or 5th week. Here again the chicks are thin and do not grow normally. There will be a watery discharge from the eyes and nostrils with an accumulation of a cheesy-like material in the sinuses and again the pustules in the mouth.

The condition is usually corrected quite easily by the addition of one of the high vitamin A containing fish oils to the diet. This can be done very simply by putting the oil in the water or into the feed.

VITAMIN D DEFICIENCY OR RICKETS

This disease is characterized by the improper growth and development of the skeletal system. Vitamin D, calcium, and phosphorus must all be present for normal bone development and a lack of any one of the three may result in rickets.

The principal sources of vitamin D for poultry can be found in fish oils, D-activated animal sterol, sunlight, and green feeds. The two minerals are usually furnished through mineral supplements.

The early stage of vitamin D deficiency is usually referred to as a leg weakness; however, the slow growth, rough feathers and generally unthrifty condition of the chicks will be noticed about that time. Affected flocks are nervous and excitable. The various joints become very tender and painful. Affected chicks can usually be observed sitting down to eat or drink. Examination of these chicks will reveal a very soft beak, leg bones that will bend without breaking, usually a crooked or distorted keel bone and a folding of the ribs.

To correct vitamin D deficiency, a high potency fish liver oil may be added to mash or placed in the drinking water. It may be necessary to remove the scratch grain from such affected flocks until the condition is corrected. Commercial mashes are well fortified with vitamin D and the essential minerals at the time of mixing.

VITAMIN G DEFICIENCY OR "CURLED-TOE PARALYSIS"

This condition is also called riboflavin deficiency and is the result of the lack of riboflavin for poultry feeding. This vitamin G is supplied through dried yeast, dried whey, skim milk, alfalfa leaf meal and fermentation products.

Where there is a vitamin G deficiency in the starting mash, chicks may show symptoms between the first and second weeks. The birds move with difficulty and when they are forced to move they walk on their hocks or with toes curled inward. In resting, they assume this same position and balance themselves with wings braced against the floor. Post mortem examination fails to reveal any changes that can be recognized with the naked eye. Microscopic examination of the nerves in the affected limbs reveals degenerating changes. Vitamin G deficiency in hens results in very poor hatchability of the eggs they produce.

This condition responds rapidly to the addition of one of the vitamin G rich supplements.

VITAMIN E DEFICIENCY

(Also Known as Encephalomalacia & Myopathy)

This is primarily a disease of chicks between the third and fifth weeks of age. This vitamin is found in alpha-tocopherol, as well as in certain of the vegetable oils such as cottonseed oil, wheat germ oil, peanut oil and some soybean oil.

This disease is characterized by a more or less sudden onset and with an involvement of the nervous system. The symptoms vary with the different birds that are affected. Some show convulsions, others paralysis, while

still others show forced movements of the limbs. Post mortem examinations of these chicks usually reveal hemorrhages in some parts of the central nervous system and, of course, the location of the hemorrhages determines the type of symptoms shown. This disease does not affect all types of poultry in the same manner. In ducklings, there is usually a degeneration of the skeletal muscles, while the other organs do not seem to be involved. This degeneration of muscles makes the birds first appear weak. When they are unable to get about the pens they will still eat if feed and water is placed before them. Upon autopsy their muscles will appear very pale in color in contrast to the normal dark red of the duck tissue. Turkey poults' lesions are usually limited to the gizzard wall. Grayish-white areas appear in the wall of this organ and these areas are harder than the adjacent normal tissue.

Vitamin E is essential in the diet of the laying flock for hatchability. In the absence of it, the death of the embryo comes very early in the period of incubation. Losses from this disease can be stopped very readily by the addition of one of the vitamin E rich supplements.

PEROSIS (Slipped Tendons)

This disease is characterized by an enlargement of the hock joint and by the tendon over this joint slipping to one side. At one time it was observed quite frequently, but as more and more information accumulates from experimental work remedial measures are taken by feed manufacturers. Deficiencies in manganese, biotin, choline and improper balances of calcium and phosphorus may cause perosis. It is possible that other unknown factors are also involved.

In addition to the enlarged hock joint the leg bones may be twisted. The affected leg may stick out to one side instead of in its normal position. One or both legs may be affected.

There is apparently no treatment for the affected birds. They should be removed from the flock immediately. If new cases continue to develop the entire management and feeding program should be gone over very carefully before any mineral or chemical is added to the feed.

GIZZARD EROSIONS OR ULCERATED GIZZARDS

This is another one of those elusive problems for which no satisfactory explanation has been found. Gizzard erosion can be demonstrated in chick embryos as early as the 18th day of incubation. A majority of the chicks hatching will show some evidence of erosions; however, very few flocks are affected badly enough to cause any considerable amount of trouble. Occasionally, gizzard erosions in chicks during their first 2 weeks of life may be diagnosed as the primary cause of their stunted condition; however, it is more often secondary to some management practice.

The lesions of this disease are limited to the lining of the gizzard and in making a diagnosis of this it should be made only after all other possible factors have been eliminated.

Medicinal agents in the drinking water have not been shown to prevent or to correct this disease.

POISONING IN CHICKS

This is an extremely unusual situation, but in each poultry producing area a few cases of it will be observed each year.

One of the most common types of poisoning today is from carbon monoxide gas resulting from incomplete burning of fuels, especially oil. With this, a considerable number of birds are found dead without having been observed to be sick and a post mortem examination will reveal the muscles and internal organs to have a bright red color.

Some poultry raisers like to put baking soda in the drinking water for baby chicks. This is of little or no benefit to the chick and if kept up for too long a time or used in too great a concentration will affect the kidney and cause the death of the bird. Such birds have a chalk-like deposit in and on the internal organs.

If common table salt is fed in excess to baby chicks it may cause a high mortality. Such chicks will have very moist droppings and an accumulation of water under the skin and in the body cavities. These chicks have been called "water bellies" or "water logged." The situation will correct itself if the cause is removed.

Botulism (food poisoning) is rather common in birds on the range. It is caused by the birds eating food that undergoes a certain type of decomposition. On the range this most often results from the eating on the carcasses of other birds or animals which have died. Botulism poisoning affects the nervous system so that the birds become completely paralyzed. Death or recovery usually takes place within 24 hours after symptoms are shown. If the condition appears in the flock and the owner knows that several birds have eaten of the contaminated material, he should attempt to flush them immediately.

Lead poisoning may be observed in an occasional bird. This is usually the result of eating small pieces of galvanized wire or nails, or drops of paint may be picked up from the ground around newly painted buildings or fences. Wild waterfowl frequently suffer from lead poisoning when they have been feeding in areas that have been hunted over for a long time.

DEHYDRATION

Dehydration, or water starvation, is a quite common finding in baby chicks and turkey poults. This may involve only an occasional bird or

many birds. It is most often seen in birds that have been held in transit too long, or in flocks where there has been a sudden change in the type of waterers.

The chicks become droopy and weak. The skin of the shanks has a withered appearance. If the condition appears during the first week, the symptoms may be confused with pullorum disease. When such birds are opened the flesh is very red and sticky. The contents of the crop and gizzard will be crumbly.

In placing chicks or poults in a brooder, be certain that there are sufficient waterers placed so that the birds will find them.

Bacterial Diseases

PULLORUM DISEASE

Pullorum disease is no longer a major poultry disease in the northeastern United States. Not many years ago it was one of the more important diseases in this section. The testing programs of the various states together with the quarantine regulations on birds imported from infected areas has accounted for the success of the control program. Pullorum may result from infected parent stock, infection in the incubator or infected premises. Infection contracted through the egg or in the incubator will cause losses as early as the third day of life. The severity of the losses will increase daily for the next five to seven days, remain high for the next five days and then gradually decrease in number. Losses after three weeks will depend upon the amount of care and sanitation given the flock during



Courtesy Department of Veterinary Science, University of Massachusetts

Uneven growth and stunting caused by pullorum disease

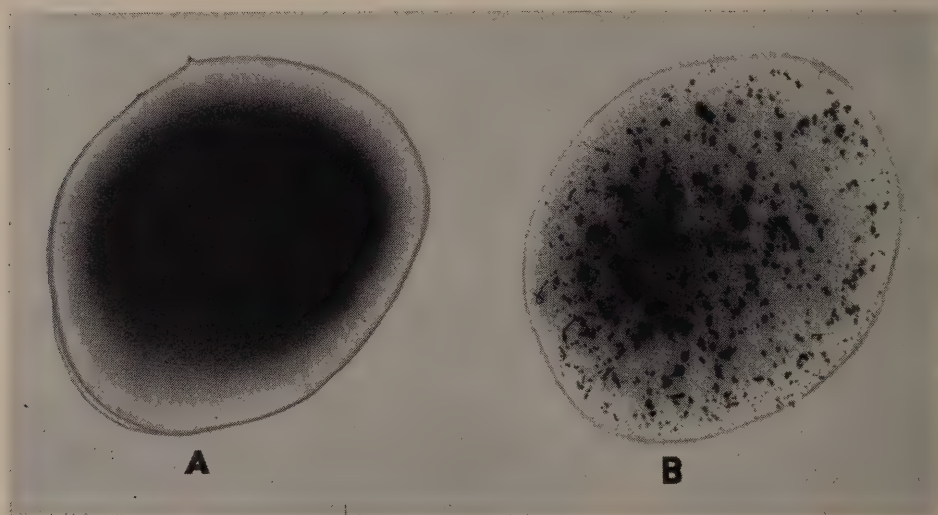
the outbreak. Pullorum contracted after the third week of life seldom causes mortality but such birds are usually carriers.

Signs

The first chicks to die in an outbreak die more or less suddenly without having been observed sick. Affected chicks will stay near the brooder as if chilled. Their wings droop and they may gasp for breath. Fecal matter may adhere to the down about the vent. Upon examination of the dead chick, a variety of lesions may be observed, but rarely are they all seen in one bird. Some of these are: (1) unabsorbed, discolored yolk, (2) ochre-colored liver, (3) yellowish-white plugs in caeca, (4) greyish nodules in the heart and gizzard muscles and in the lungs, and (5) small yellow pinhead size areas throughout the liver. The chronic form of the disease, as seen in mature birds, is almost always limited to the ovary. If this organ has not been active it may appear normal, but the infected active ovary will have greenish-brown or yellow-brown misshapen yolks.

Control

The pullorum phase of the National Poultry Improvement Plan is the basis of all pullorum control programs in this area. The success to date is an example of what can be accomplished in a disease control program when there is a will and a desire on the part of all segments of the industry to do away with this unnecessary loss. Unfortunately, all infected chicks do not die, but some will live to become carriers of the disease. For this reason, a blood test on the mature birds must be made each year to eliminate the infected carriers. If the flock passes two or more clean annual tests, it is rated as *Pullorum Clean*. If it passes one clean test it is rated *Pullorum Passed*. A hatchery takes the rating of its lowest supply



Pullorum tests as viewed through the microscope. A. Negative, B. Positive

flock, i.e., if a hatchery is getting eggs from 10 pullorum clean flocks and one pullorum passed flock, then all chicks must be sold as *Pullorum Passed*.

Lists of approved pullorum clean and pullorum passed flocks and hatcheries may be obtained through either the State Board of Agriculture, State Department of Agriculture or the Poultry Department of the State Agricultural College.

FOWL TYPHOID

This disease is usually encountered during warm weather, especially during the months of July, August, and September. All ages of birds seem to be susceptible; however, it is not usually considered as a disease of baby chicks. Affected birds become listless, develop a diarrhea and the comb and wattles become congested. The symptoms may be similar to those seen in birds with Blue Comb Disease or sub-acute Cholera.

Symptoms

The start of the outbreak may be explosive with many deaths in a few hours or in other cases the infection may be relatively mild with a large number of birds off feed and stunted before the flock owner realizes the disease is present. Affected birds may have a high fever with the resulting shriveled appearance of the comb and shanks. Such birds have a dehydrated sticky flesh when examined. The livers are swollen and have a greenish-bronze color. They may be studded with white or yellow foci or spots. The intestines are inflamed and contain much bile stained mucus. A definite diagnosis of Fowl Typhoid depends upon the isolation and identification of the fowl typhoid germ.

Control

Control measures today are not too satisfactory. In most instances, the sale of the affected flock followed by thorough cleaning and disinfection is the best method of handling. Vaccines may give some measure of relief, but are not dependable. Then too, birds that are vaccinated with a fowl typhoid vaccine, as well as recovered birds, will usually react to the pullorum blood test. This test may be used to remove the fowl typhoid carriers from a flock of valuable breeding birds in some instances. Certain sulfa drugs have been used to bring the outbreaks under control in broilers. This is a temporary and costly measure that will keep the flock intact until it can be marketed. Outbreaks even in the same community seem to vary greatly in their severity.

PARATYPHOID

This disease is most often encountered in young turkeys and ducks, but may occasionally be found in chickens. In many respects it resembles Pullorum disease in chicks, except that the greyish-yellow nodules are

rarely found in the heart, lungs, and gizzard. A definite diagnosis of paratyphoid can only be made by a bacteriological examination.

Signs

Affected birds are listless and if death does not come quickly a diarrhea develops. In young birds cheese-like plugs may develop in the caeca and in older birds greyish pink thickened areas, up to one-fourth of an inch in diameter, may develop in the wall of the small intestine.

Control

Again some of the sulfa drugs may give temporary results until the birds can be marketed. Survivors should not be kept as breeding stock since many of them will be carriers. Birds that are vaccinated against paratyphoid may react to the pullorum blood test. Testing to remove paratyphoid reactors is both costly and unsatisfactory at present.

CORYZA

This is a respiratory disease of chickens caused by a bacterium known as *Hemophilus gallinarum*. The disease appears to be more common in areas where birds are kept in confinement for long periods and also on breeding farms where several different ages of birds are kept.

Signs

The first evidence of coryza is usually a slight nasal discharge and the nostrils soon become stopped up. There will be considerable shaking of

the head, sneezing and some coughing in an attempt to dislodge this dry mucus. There is no offensive odor at this stage. If the birds are not treated early in the course of the disease, secondary infections usually develop and swollen sinuses or infected eyes result. A diarrhea usually develops simultaneously. Such birds go out of production and lose weight rapidly. Most cases will terminate fatally if neglected.



Courtesy Department of Veterinary Science
University of Massachusetts

Infectious Coryza: Swelling below the eye and nasal discharge caused by *H. gallinarum*

Control

When possible, the disease should be eradicated rather than treated.

This can usually be done by rearing all replacements out of contact with older diseased stock and by disposing of this old stock before housing the younger ones. Of course, a thorough cleaning and disinfecting of the

equipment and buildings are indicated. The outbreaks can be brought under control through the use of sulfathiazole or sulfaquinoxaline in the feed if the disease is recognized early and treatment started at once. Many treated recovered birds will remain as carriers and spreaders of coryza.

FOWL CHOLERA

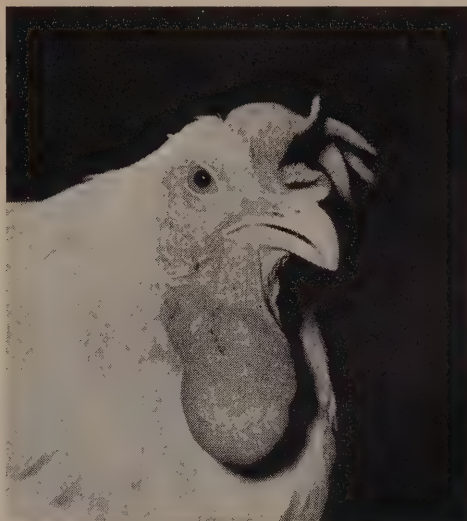
The fowl cholera germ was the first germ to be isolated from any poultry disease. While much has been learned about fowl cholera, we still do not have satisfactory control measures. The disease is world-wide in its distribution and it may affect any of the domesticated birds in one of the following ways: (1) as a very acute septicemia or blood form, (2) a chronic type causing a swelling of the wattles, feet and/or joints or, (3) a respiratory type resembling coryza and commonly called "roup". All of these various forms may be seen on the same farm during an outbreak. As a general rule the acute or septicemic form is more common in warm weather and the other two types in colder weather and cooler climates.

Signs

In the acute outbreaks birds may be found dead without having been observed to be sick. Such birds will show a congested comb and wattles. The internal organs will show many small hemorrhages. This is especially so of the heart and the heart sac. The liver is swollen, congested and may contain many small yellow foci or spots. The kidneys are pale and may be filled with urates. The intestine will be inflamed. Smears made from the blood of such birds reveal numerous fowl cholera germs when they are stained and examined microscopically. The other two types of fowl cholera are more difficult to diagnose. One swollen wattle may be the only symptom shown and the bird will appear normal and live until disposed of. Such a bird, however, may act as a carrier and spreader of the infection in the flock. The respiratory form may be mistaken for coryza or chronic respiratory disease. In all instances a fowl cholera diagnosis should be confirmed by a bacteriological examination in a laboratory.

Control

The most satisfactory control practice to date is to depopulate, clean and disinfect. When possible, the buildings should be left empty



Courtesy Department of Veterinary Science,
University of Massachusetts

Fowl Cholera: Swollen wattle infected with cholera organism

for at least 30 days. Some of the sulfa drugs, especially sulfaquinoxaline, sulfamerazine, and sulfamethazine have been effective in checking the mortality. This is especially important in outbreaks of the disease in turkeys. Medication has made it possible to hold the flock with a minimum of losses until they reach a marketable size.

AVIAN TUBERCULOSIS

In chickens this disease is caused by the avian type tuberculosis organism. It usually spreads very slowly in a flock and infected birds may live for several weeks or months. It is rarely seen in pullet flocks but is most often observed on farms or in areas that make a practice of keeping hens for two or three years.

Signs

Avian tuberculosis develops slowly so that the hens get very thin, pale and weak. The symptoms may be confused with heavy parasitism or leucosis. When the dead birds are examined yellow or white nodules may be seen in the liver, spleen, lungs and in the wall of the intestine. The larger nodules have a distinct wall and will contain pus. Some of the ones on the intestine may rupture into the gut and cause great numbers of the tuberculosis germs to pass into the droppings. They can then contaminate the feed, water or grit of other birds to reproduce new cases of tuberculosis.

Control

To completely depopulate the premises of all poultry is the most satisfactory method of control. All birds, both dead and alive, should be removed and the building thoroughly cleaned and disinfected. If the pens have a dirt floor about 4 inches of the soil should be removed and replaced with clean sand. All manure piles should be taken to a part of the farm not frequented by poultry. Outside runs should be cleaned up and left idle if possible. The length of time to leave them idle will depend upon the drainage and type of soil. A well-drained sandy soil should be safe after one summer. A poorly drained run with clay soil may require two years. In valuable breeding stock the tuberculin test made every 60 days will bring the disease under control if it is followed by the removal of the reactors and the cleaning of the building. Such a program would permit the hatching or replacements from this stock before it is destroyed. Avian tuberculosis is rarely if ever transmitted to man.

STAPHYLOCOCCOSIS (Pus Infection)

Staphylococcal infections in chickens and turkeys is an unusual type of infection and its methods of spreading are not wholly understood. The condition is most often seen as causing swollen hocks in birds. If these swellings are opened, a yellowish fluid or pus is observed. However, the organism is also frequently encountered in breast blisters and necrosis of

the large tendon in the leg. Since this latter condition has not been reproduced experimentally the staphylococci may be secondary.

The method of infection or spread is not known. The organism seems to be universally present, but only occasionally invades the tissue. Breaks in the skin may be the point where the infection enters.

Control

Destroy all infected birds as soon as noticed. In case of valuable breeding birds or turkeys, the use of penicillin in large doses in isolated birds may result in some recoveries.

NAVEL INFECTION (Omphalitis)

This disease is usually considered as being caused by faulty incubator sanitation or management. However, North Dakota workers have reported a type of navel infection that appears to be egg borne. No one type of germ is consistently found. Any one of a variety of bacteria can get into the unhealed navel at hatching time or soon afterwards.

Symptoms

Death losses start almost immediately after hatching and will continue for as much as two weeks. Affected birds do not grow normally. They will have an inflammation and discoloration about the navel and there is usually a scab over it. Some of the affected birds will show an excessive amount of fluid under the skin and in the body cavity. The yolks are usually unabsorbed, semi-solid and at times very putrid.

Control

The correction of the faulty fumigation or operation of the incubator will usually prevent the trouble. If the trouble is from removing the chicks from the incubator too soon or placing them in used soiled chick boxes, then preventive measures are self-evident.

MYCOSIS (Sour Crop or Thrush)

This is a rather common condition in some areas and is caused by molds or yeast-like organisms growing on the crop lining.

Symptoms

Affected birds are depressed and stunted. There is usually an increased amount of water in the crop and this may be very putrid. The crop lining will have dirty greyish patches on its surface. If these are scraped off a raw bleeding surface is observed.

Control

Improved sanitation will usually check the disease. Clean and disinfect the waterers and feeders. Place them so that droppings cannot contaminate

them. If floors cannot be kept dry then all scratch grain and grit should be put in feeders. The use of copper sulfate in the drinking water may be of some value as a treatment. Make stock solution by dissolving one-half pound copper sulphate in one gallon of water. Give three level teaspoonfuls of this stock solution to each gallon of drinking water on alternate days for one week.

ASPERGILLOSIS (Brooder Pneumonia)

This is a respiratory infection caused by the inhalation of a specific mold spore. The spores usually are on moldy straw or sawdust used as litter but may be in the feed as well. The moldy material may be eaten with little or no harmful results. All species of domestic birds seem to be susceptible.

Symptoms

The number and location of the lesions determine the symptoms that the bird shows. Heavy infection results in numerous nodules in the lungs and the birds will gasp for breath. A few lesions in the air sacs will cause the birds to lose flesh and be listless. At times paralysis and other nervous symptoms resembling Newcastle disease may be observed. The older air sac lesions are circular in shape and will be either yellow or greenish-brown in color.

Control

There is no treatment for infected birds. If several are affected, remove all of the moldy litter as soon as possible. Usually only an occasional bird is affected and complete cleaning will not be indicated.

Virus Infections

These are primarily respiratory diseases in poultry. All of them are very contagious and they usually affect a large percentage of the birds in the flock.

NEWCASTLE DISEASE

This disease has become very common throughout the commercial poultry raising areas of the United States. The severity of the outbreaks is extremely varied, even on the same farm. The strain of virus, age of the birds, weather conditions and secondary infections all influence the course of the disease.

Symptoms

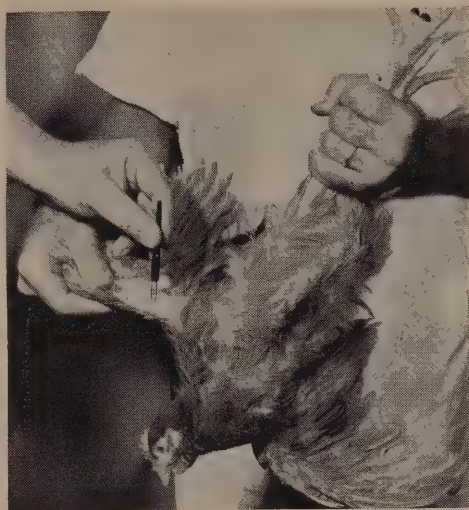
Newcastle disease starts as a respiratory disease, but in some outbreaks nervous disturbances follow very quickly. Affected birds will gasp and sneeze. In those that survive for a few days, some will show some type of nervous symptoms. This may be a paralysis of some part of the body, blindness or just incoordination. The only lesions may be the accumula-

tion of mucus in the nasal passages and trachea. Some of the birds will have cloudy air sac membranes. As secondary complications develop a variety of other lesions will be observed. Newcastle disease in a laying flock causes almost a complete stop in egg production. The pause is not as long as for bronchitis and the eggs also return to normal color and normal texture much sooner. Outbreaks in growing birds on the range in the summertime may be so mild as to go unnoticed.

Control

Since the disease is so widely distributed in this country some vaccination must be used in its control. There are three types of vaccine being used. All three will give a measure of protection, but none of them are entirely satisfactory. This is not surprising since recovery from natural outbreaks will give only about 80% protection against challenge doses of the virulent Newcastle virus.

In the broiler areas the intranasal vaccine given at one day of age, either at the hatchery or on the farm, is a popular practice. This gives satisfactory results in most flocks up to about 8 to 10 weeks of age. From that time on the degree of immunity decreases. The more virulent wing web type of vaccine is usually used in birds to be kept for layers but also has wide usage in the broiler industry. If possible, the vaccine should not be used in chicks under 4 weeks of age. In the broiler areas, when the disease is a constant threat, it is necessary to use it at 10 to 14 days of age. A



Courtesy Lederle Laboratories

Wing-web method of vaccinating for Newcastle

reaction to the vaccination follows its use and this may result in a mortality of from 1 percent to 5 percent. Immunity from the wing web type of vaccine will usually last for a year unless the birds are subjected to an extremely severe type of Newcastle virus. The killed vaccine is in quite general use in the mid-west and to a lesser extent in the east. It has a disadvantage of giving immunity of short duration (8 to 10 weeks), but the advantage of having no adverse reaction following vaccination. It should be used at 10 to 14 days of age for best results.

In some flocks that are to be sold as fryers or roasters, it is advisable to give a second vaccination. In so doing, it is recommended that the second one be the same as the first, i.e., follow intranasal with intranasal, killed with killed and wing web with wing web. Sometimes the intranasal vac-

cine is applied in the eye instead of the nostril. This is satisfactory and easier. When Newcastle threatens a flock of unvaccinated layers, the killed vaccine may be used. This does not produce a systematic reaction and it will not throw the birds out of production.

INFECTIOUS BRONCHITIS

Infectious bronchitis is caused by a filterable virus. It is a common disease seen in poultry producing areas of this country.

Signs

The disease may affect chickens of any age but is not infectious for turkeys or waterfowl. It develops and spreads very rapidly. Birds may show symptoms (gasping and sneezing) within 24 hours after the first exposure. In baby chicks under 2 weeks of age, mortality may be very high — up to 80%. The mortality rate decreases very fast as the birds get older so that very few birds over four weeks of age will die unless it is complicated with some other condition. If bronchitis appears in the laying flock, probably less than 2% of the birds will die, but they will go out of production and many will go into a moult. This may mean 90 to 120 days before they come back into production. When production is resumed the eggs are very abnormal in color, shape, texture, and interior quality. It is very difficult to distinguish between infectious bronchitis, Newcastle disease and laryngotracheitis at the start of an outbreak.

Control

At present there is no satisfactory vaccine that can be used to prevent infectious bronchitis. Birds that have the disease and recover are usually immune for at least one year. A number of states have adopted a control program for their concentrated poultry areas that is based on infecting their young birds during the growing period. This is best done when the birds are 6 to 14 weeks of age. The diluted virus is furnished by a central laboratory and one or more birds in each range shelter is inoculated with a tracheal swab or the material may be used as a fine mist over the birds in the shelter. These birds develop typical symptoms of infectious bronchitis and unless secondary complications develop, recovery is usually complete in about 10 days and the birds are immune to go into laying quarters. Such a program is not practical for the broiler producer.

LARYNGOTRACHEITIS

This is the killer among poultry respiratory diseases. All age birds are susceptible and a death rate of 75% is not uncommon.

Signs

The first symptoms are sneezing and coughing. The spread of the disease is very rapid throughout the flock. After the first 24 hours there is an accumulation of blood-stained mucus in the trachea and as the bird attempts

to get rid of this there is much shaking of the head. Affected birds will stay on the roosts, extend their necks, and breathe through their mouths. The inflamed trachea becomes lined with a yellow blood-tinged material. Portions of this lining break away and as the bird attempts to cough



Courtesy Lederle Laboratories

Fowl Laryngotracheitis: Affected birds will stay on the roosts, extend their necks and breathe through their mouths

them up they will lodge in the opening of the trachea. This produces suffocation and the birds die in convulsions. The development of this caseous yellow lining in the trachea has caused some people to refer to the disease as avian diphtheria.

Control

At the present there is no satisfactory treatment for affected birds. If the affected birds can be placed in a heated room that is free of ammonia fumes, some relief may be had. The use of inhalents, such as beechwood creosote, will also give some relief.

In areas where laryngotracheitis is rather common, the poultryman should plan to vaccinate all birds (in some states it is necessary to get permission from the proper authorities to use Laryngotracheitis vaccine). In the more congested areas such as the Delmarva broiler section it may be necessary to vaccinate as early as four weeks of age. In other less congested sections it may be possible to delay vaccination until 12 or 14 weeks. The material used for vaccination contains a very virulent virus and if it is used carelessly or is spilled accidentally around the poultry plant it may cause the disease. All empty vaccine containers and unused vaccine should be

burned. If the flocks are healthy at the time of vaccination, the reaction will be rather mild.

However, if it is complicated with any other respiratory disease the losses may be heavy. If laryngotracheitis appears in an unvaccinated flock and is recognized immediately the rest of the flock should be vaccinated at once. This may not prevent the spread of the disease, but will lighten the attack and reduce the mortality.

The vaccination program may be discontinued on a farm if rigid sanitation is provided and close supervision of the flock is maintained.

CHRONIC RESPIRATORY DISEASE (Air-Sac Infection)

This condition was first described by Delaplane in Rhode Island. It was an infection of the sinuses and trachea that was characterized by much sneezing and coughing, decreased egg production and low mortality. The disease persisted on the farms for a long period of time. Since Delaplane's first observation the disease has been reported from most of the major poultry producing states. Today it is recognized as one of our major poultry diseases.

Signs

The signs or symptoms, shown by the affected birds, will vary a great deal. Much depends upon the age of the bird affected, the time of the year and other diseases that may be present at the same time.

In the laying flocks the disease will start out like a rather mild infectious bronchitis outbreak. However, the spread from pen to pen is rather slow and production in the affected pens does not go below 30 to 40 percent. The coughing persists for the remainder of the winter but tends to disappear in the summer.

In younger birds the disease may appear at any time after 3 weeks of age and is rather common in 5, 6 and 7 week old chicks. The symptoms are much the same as in older birds but the condition in broilers is frequently associated with Newcastle disease or the reaction from Newcastle vaccination. It may also be associated with infectious bronchitis or any one of other conditions which might weaken young chicks. In young birds the death loss may be as much as 50%. Losses of 25 to 30% are common in the colder months.

Lesions

When the young birds are opened for examination the lesions may be only an excess of mucus in the trachea, in others the air sacs will be clouded. In extreme cases the air sacs will contain cheesy-like yellow exudate. The infection may spread to the heart and to the liver. A few cases will have an infection of the sinuses.

Control

When the disease occurs in mature birds it is advisable to sell all birds on the farm before new chicks are brought on the premises. The infected pens should be cleaned and disinfected. Do not attempt to put new birds onto a built-up litter where infected hens have been. The organism or germ that causes this disease is readily killed by some of the antibiotics. However, very few severely infected flocks respond satisfactorily to the feeding of these compounds. The birds may show some temporary response on antibiotics, but it is not a permanent cure. There is no vaccine available against chronic respiratory disease. Infected birds that may recover from an infection through treatment can be reinfected.

Unfortunately, chronic respiratory infection or, as it is commonly called, "air-sac infection," may be a combination of two or more infections. Approximately 80% of the broiler flocks having a clinical picture and history of air-sac infection were found to be harboring Newcastle or infectious bronchitis virus. It is not known whether one of these two viruses can weaken the bird so that the chronic respiratory agent can take over or if the birds are weakened by the chronic agent and the virus infections cause the heavy death losses. Many of the outbreaks occur about one week after the birds receive the combined Newcastle (wing web) and laryngotracheitis vaccines at about 4½ to 5 weeks of age.

There has been some circumstantial evidence presented which indicates that this agent can be transmitted through the egg to the chick from the infected hen. This has not been conclusively proven yet.

FOWL POX

This is a very common disease of chickens and turkeys throughout this area. It is caused by a filterable virus. The lesions are primarily on the skin but may, at times, affect the mucous membranes of the mouth and produce respiratory symptoms.

Signs

The first symptoms of fowl pox are small raised pale areas on the unfeathered skin of the head. These develop into small blisters that later rupture and then heavy dark brown scabs form. These differ from scabs that form over injuries in that they are very adherent to the underlying tissue and they are also much heavier. Quite often the early lesions are observed on the eyelids and in the corners of the mouth. The scabs persist for about two weeks and then begin to drop off. The eyelids may become so affected that the birds cannot see to eat or drink. In some outbreaks numerous lesions occur in the mouth. These do not have the characteristic red-brown scab but remain grayish-yellow. It is sometimes referred to as "Wet Pox." The occurrence of wet pox is more common in turkeys than in chickens.



Courtesy Department of Veterinary Science
University of Massachusetts

Fowl Pox: Active lesions of pox on comb, wattles and skin of face

The fowl pox virus in the scabs is very resistant and may live for several months, especially in the colder weather. The disease can be transmitted through contact with infectious material and by the bites of certain mosquitoes and other biting insects. In laying flocks the cockerels spread the disease very rapidly throughout the flock.

Control

In areas where this disease is common all birds should be vaccinated against it. As a general rule, broilers are not vaccinated unless several different aged birds are on the same farm. Pullets that are to be kept for layers should be

vaccinated between eight and sixteen weeks of age. Some poultrymen find it desirable to do this operation at the time the birds are being transferred from the brooder house to the range shelters.

The vaccine may be administered in one of three ways: (1) wing web, (2) feather follicle, and (3) stick method. The wing web method is used most extensively today. It is done by the use of an instrument containing



Courtesy Lederle Laboratories

Feather follicle method of administering pigeon pox vaccine



Courtesy Lederle Laboratories

Wing-web method of vaccinating for fowl-pox

two sharp needle-like projections. Each of these needles has an eye or groove near the point. The needles are dipped in the vaccine and then passed through the web of the wing. The feather follicle method was used more extensively in the past than it is today. In using it, three to five feathers are pulled out from the side of the leg and, with the aid of a small stiff bristled brush, the vaccine is rubbed into these follicles. In using the stick method, some sharp pointed instrument such as a knife blade is dipped into the vaccine and then stabbed into the side of the leg. All three methods will give satisfactory results. A sample from each vaccinated



Courtesy Lederle Laboratories

Close-up of wing showing fowl pox "take"

flock should be examined seven to ten days later to determine if there are "takes." A "take" shows up as a small scab at the point of inoculation. This should be observed in at least 60% of the birds examined.

The use of fowl pox vaccine in layers will usually cause them to go out of production and may cause some to go into a moult. For this reason, if it is necessary to vaccinate a laying flock, the milder pigeon pox vaccine is used. This gives a very mild reaction in chickens, but, at the same time, gives a short period of protection (about three months).

It is generally felt that it is most desirable if these various vaccines (fowl pox, laryngotracheitis, Newcastle disease and the infectious bronchitis inoculations) can be given one at a time and that ten days to two weeks be allowed between their application. This is not always possible or practical. Many poultrymen are now administering both the Newcastle and fowl pox vaccine at the same time. The wing web type vaccines are used. One is given in one wing and the other in the opposite wing. This has proved satisfactory.

FOWL LEUCOSIS

(Range Paralysis, Big Livers, Grey Eyes, Tumors)

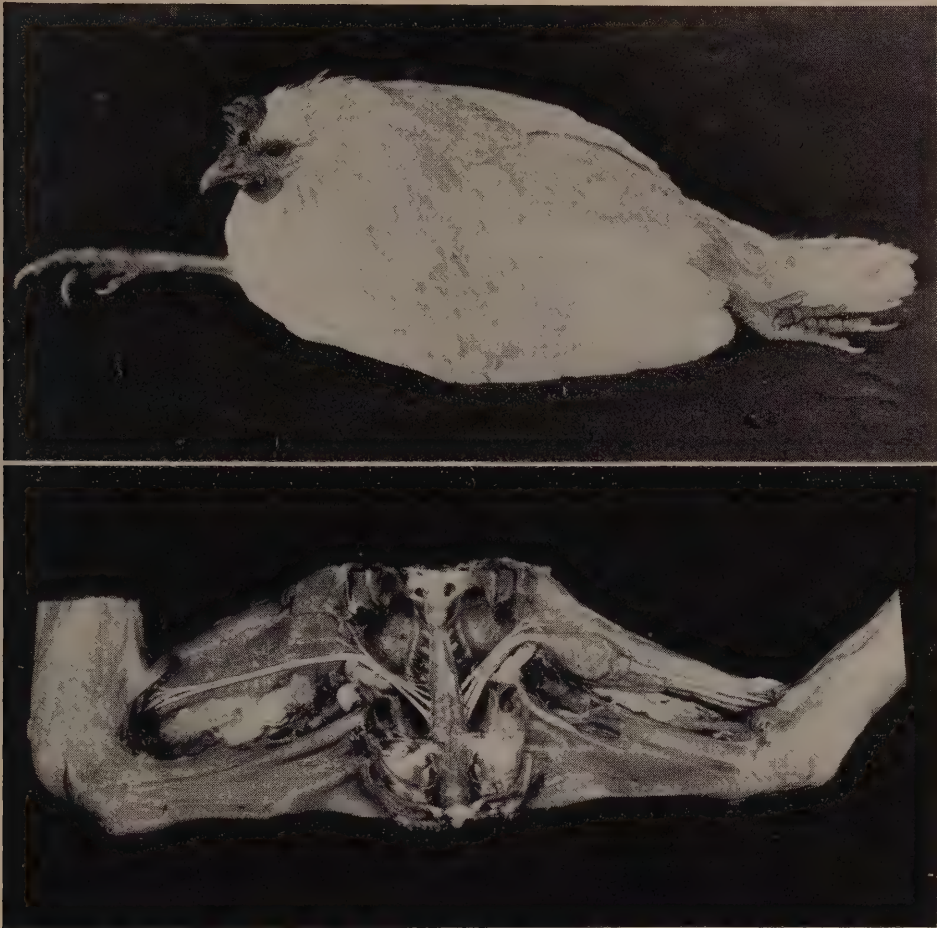
This is primarily a disease of the young adult fowl (20 to 30 weeks), but during these past two years there has been a marked increase in the amount of this condition found in broilers. The relationship of the various forms of leucosis is not clearly understood. The indications are that the various forms are all caused by the same thing (a filterable virus) but, for unknown reasons, may localize in different tissues of different birds.

The grey-eyed or blind type is more common in birds over six months of age. One or both eyes may be affected.

The paralytic or range paralysis type affects the nervous system. The particular nerve which is affected governs the part of the body that becomes paralyzed. This type is most common in birds under six months of age.

The big liver form of the disease usually involves the spleen, ovary and kidneys as well as the liver. In extreme cases, the enlarged livers and spleens may have a mottled greyish appearance or, if the growth is diffuse or large, tumor masses may be present throughout the normal appearing liver, spleen or kidney tissue.

Tumors in other tissues of chickens are not uncommon. Many of these are a part of the fowl leucosis complex; however, there are other types of tumors found in birds too.



Courtesy Department Veterinary Science, University of Massachusetts

Fowl Paralysis: (top) Pullet with paralysis of both legs. (below) Marked enlargement of nerve in the right leg

The kind of tumor cell found in the grey-eyed form of leucosis is the same as that found in the enlarged nerve of a paralyzed bird or in the big liver condition.

Signs

The symptoms that are observed will depend upon the location of the tumors. In the ocular or eye type, the eye will lose its normal bay color and become grey. As the disease progresses the pupil becomes irregular in shape and the bird gradually becomes blind. One or both eyes may be affected. Many hens that have only one eye involved will continue to lay and to maintain normal weight. Others will go out of production, become thin and die.

The paralytic form of leucosis usually affects the legs or wings. Again one or more limbs may be affected. The onset is gradual. The birds may be slightly lame at first and the flock owner will suspect an injury. The lameness will become more severe until the bird loses the use of that leg. If the



Courtesy Lederle Laboratories

Leucosis, showing affected eye and enlarged liver

bird is removed from the flock, and feed and water placed before it, it may live for several weeks. Recovery is very rare. If such birds are opened and examined carefully it is usually possible to find enlarged nerves leading to the affected limbs. The nerves supplying the internal organs may also be diseased and such birds would not appear lame.

Birds affected with the big liver type of leucosis gradually lose flesh and are droopy. No other outward signs will be shown. In some, the tumors will grow so rapidly that death will take place before the bird becomes thin. In those that live a few weeks it is not uncommon to find the abdominal cavity full of fluid as well as tumorous tissue.

Control

At this time there is no known vaccine or drug that can be used to prevent or cure this disease. There is conflicting evidence as to whether or not the disease can be transmitted through the egg. While it seems that this possibility of egg transmission does exist it also appears that it does not happen often enough to be of much significance. Experimental work indicates that the amount of sanitation and isolation practiced during the brooding and early growing period determines the amount of leucosis that will develop later. Chicks should be started away from the older broods and with equipment that has been thoroughly cleaned and dis-

infected. Whenever possible, a separate caretaker should be provided for the young birds and he should not be permitted around other older birds.

This isolation of the baby chicks and their caretaker will not only help in the control of leucosis, but it should also help to control other diseases and parasites that may spread from older birds. There is no way to determine in advance if a flock will develop leucosis later in life. Whenever possible, baby chicks that are to be raised for layers should be purchased from stock known to have good livability.

EPIDEMIC TREMORS

Epidemic tremors is a disease of chicks between the ages of five days and five weeks. It is a peculiar disease and the infection is apparently in them at the time they leave the incubator. There is very little, if any, spread between infected and healthy chicks.

Signs

The first birds to be affected are usually observed on about the fifth day after hatching. These first chicks will be paralyzed and some of them may be found dead. After finding birds in this condition for three or four consecutive days, a few will begin to show only a partial paralysis and will have definite tremors of some part of the body. The head is frequently the part that trembles or shakes but other areas may be involved. In some, this symptom is very noticeable, while in others it can be detected by holding the chick in the hand and feeling these rapid vibrations. Most affected chicks make a hoarse cheeping noise that is quite characteristic of epidemic tremors.

Control

There is very little, or nothing, that can be done as treatment for affected chicks. The death loss will vary from insignificant to 35%. When the amount of infection is great there is likely to be a considerable number of culls produced. Some birds that are affected will survive and grow but because of damage done to the nervous system they will continue to show nervous symptoms as long as they live. Affected flocks tend to be very nervous and excitable. For this reason, most poultrymen find it advisable to dispose of such flocks as broilers.

Parasitism

Parasitism has been and still is, in certain parts of the world, the condition that limited the development of a poultry industry. The major parasitic infestations in this area are coccidiosis, blackhead, round worms, tapeworms, lice and mites. With the exception of coccidiosis, these parasites usually do not

kill the bird; however, they do cause a lower egg production, slower gains in weight, and poor feed efficiency.

COCCIDIOSIS

There are eight different species of coccidia which infect chickens. Rather than discuss each of the eight we will limit this to caecal and intestinal coccidiosis. Coccidia are single-celled parasites too small to be seen with the naked eye. In the bird they penetrate the lining of the intestine and multiply until they cause the cell to rupture. These liberated parasites then invade other cells. After the third time this happens, a type of parasite (oocyte) is formed that is passed out in the droppings. If moisture and temperature conditions are satisfactory this oocyte matures into an oocyst which is very resistant to drying and disinfectants. This is the form that other chickens take in with feed, water or grit to start a new infection.

Caecal or Bloody Coccidiosis

This is the kind of coccidiosis which is best known and which has caused the greatest mortality in young birds. The infection takes place in the caeca or blind pouches.

Sign

At the start of an outbreak the caretaker may notice that the birds are drinking more water than usual. A few hours later he will observe some blood in the droppings of these birds. Within the next 24 hours chicks will start to die. If these birds are examined a few drops of blood may be found in the vent. The birds will be very pale or anemic. When the carcasses are opened, the lesions will be limited to the caeca. They will be markedly enlarged and redish-purple in color. If opened, they will be found to be filled with partly clotted blood and shreds of tissue.

Control

There are two principal methods of controlling this disease: (1) by preventing infections and (2) the use of drugs. Fatal infections may be avoided by preventing the birds from picking up large numbers of the oocysts. This is usually accomplished by using new litter on the floor and wire floored porches during the brooding period. These chicks are then moved to heavily sodded ranges. At the same time the feeders and waterers must be of a type that will not become contaminated with droppings or litter.

For the past several years many poultrymen have been feeding a low level of certain drugs or chemicals to prevent the disease or larger amounts to treat the outbreaks when they occur. There are several of these available that will do a satisfactory job and others will probably be developed. Price and availability often determine the drug to be used. For the latest information and recommendations, the poultryman should consult his

veterinarian, his feed company field man or his state extension poultry specialist.

Intestinal Coccidiosis

This term is usually used to designate all other types of coccidiosis. There is a tendency on the part of some to refer to intestinal coccidiosis as the chronic type. This is not necessarily true.

Sign

In the intestinal form of coccidiosis hemorrhage may take place in the intestine but the blood is acted upon by the digestive juice so that it is not recognized as blood in the feces. The affected birds appear stunted although they may eat normally. The wing feathers seem to out-grow the rest of the body. The head is very pale and the beak is not worn off normally. The chicks have that characteristic "crow-headed" appearance. Upon autopsy, the lesions will be limited to the intestine. It will be thickened. In some cases numerous greyish-white areas as well as small hemorrhages can be seen from the outer surface of the intestine. The inner surface will contain small hemorrhages and there may be some blood in the intestine.

Control

The control of the intestinal type of coccidiosis is much more difficult than it is for the caecal type. Since high mortality is not associated with the outbreak, the disease is often well established before it is recognized. The same control measures used in the control of caecal coccidiosis are applicable here. Intestinal coccidiosis does not respond as readily or as fully to some of the coccidiosis suppressive drugs.

BLACKHEAD

(Infectious Entero-hepatitis)

This is primarily a disease of turkeys but at times it becomes a serious problem in chickens. Blackhead is caused by a protozoan parasite. This parasite may be carried by the caecal worm and be transmitted through the egg of this worm.

Signs

Blackhead is usually seen in growing birds between 6 and 16 weeks of age. The disease has been observed throughout the year; however most of the outbreaks may be quite sudden. Some birds may be found dead while others will be weak and toxic. The combs and wattles may be congested. The droppings will be greenish-grey in color and will contain much bile and mucus. As these droppings dry they become sulphur colored and this yellowish material can usually be detected on the feathers about the vent.

When affected birds are opened, the lesions will be limited to the liver and caeca or blind gut. The liver lesions are yellowish in color and will vary in

size from that of a pin head up to one-half inch in diameter. The edges of these lesions are not as distinct as those usually observed in turkeys affected with this same disease. The caeca may or may not be involved. If involved the organ will be enlarged and will contain a firm yellow plug.



Courtesy Poultry Department, University of New Hampshire

Blackhead in chickens showing caecal lesions and affected liver

Control

To control this disease one must either prevent the infection or resort to drugs as a treatment. The infection can only affect birds if it is taken into the digestive tract. When the disease appears it usually means that the feed, water or grit has become contaminated with infected droppings. If the birds are confined to a house, the disease in chickens can usually be brought under control by practicing a good sanitary program. Where the disease appears in birds on the range or when it is impossible to control it by practicing common sense sanitary measures on confined birds, then the use of **ENHEPTIN** will help. For chickens this drug is usually placed in the drinking water instead of the feed. Sick birds will drink medicated water when they will not eat mash. Enheptin should be used until the death loss has stopped and then withhold it unless, or until, losses start again. The symptoms of blackhead are so similar to those of fowl cholera and fowl typhoid that a definite diagnosis should be obtained before any treatment is started.

ROUNDWORMS (*Ascarids*)

The common roundworm can be found in most of the poultry flocks of the nation. It has been shown that a heavy worm infestation stunts the growth of birds, slows maturity and decreases egg production. It is not

known, however, what effect if any, the presence of two or three worms in the intestine will have on a bird. Mature roundworms are about as large as the lead in an ordinary pencil and up to three inches in length. The females are larger than the males. Literally millions of eggs are produced by the females. They are passed in the droppings of the bird and in a few days a tiny embryo is formed within the shell. These may live for several months in this stage. If they are taken into the body with the feed, water or grit, the shell is digested off and the embryo grows to maturity. It takes 56 days for the worm to mature after the egg enters the body.

Signs

The first signs of worm infestation will be similar to intestinal coccidiosis. If the flock is young they will be uneven and rough. The birds will drink more water than usual and will have very watery droppings. Worm infested mature birds are likely to be thin and in a low level of production. A final diagnosis can be made by examining affected birds and finding the parasites in the intestinal tract. The examination of dead birds for parasites is not too successful.

Control

Whenever possible, prevent roundworm infestations from developing. This is done by placing worm free birds on clean litter and supplying clean feed, water and grit. Use a type of feeder and waterer that is not easily contaminated with droppings. If birds become infested they should be treated as soon as possible. A number of products can be used but some form of nicotine sulphate is most often recommended. These are mixed in the feed and the treatment may be repeated in ten days if necessary.

Some poultrymen prefer to give their birds an individual treatment for worms. In so doing he knows that each bird receives a full dose of medicinal material. Most of the drugs or chemicals that are used in the feeds may also be purchased in pill or capsule form for individual treatment.

CAECAL WORMS

These are small worms about one-half inch in length and are found in the caeca or blind pouches. In small numbers they do not appear to have much effect upon the chicken. This parasite is a carrier of the protozoan which causes blackhead.

Control

The caecal worms are usually found in considerable numbers in the tips of the caeca. Because of their location they are not easily reached by the drugs commonly used. This is why some agent must be mixed with the feed and fed for several hours. Phenothiazine may be used in this way.

It is relatively non-toxic to the bird, yet very effective against caecal worms.

TAPEWORMS

There are several different kinds of tapeworms found in chickens. They vary in size, from those just visible to the naked eye to some that may be six to eight inches long. They are white, flat ribbon-like parasites with the head firmly attached to the intestinal wall of the bird. The worm is made up of a series of segments or links and as these segments mature and fill with eggs they break off and pass out. New segments develop up next to the head. All tapeworms in poultry must have an intermediate host to complete their cycle. In other words, the tapeworm eggs must be eaten by some fly, beetle or slug which in turn are eaten by the chicken.

Signs

Affected birds become very pale, listless and thin.

Control

There is no efficient treatment available today. If feed is withheld from birds for 12 hours and followed by an epsom salts flush, many of the tapeworms will be removed. Manure piles containing tapeworm eggs should be spread at considerable distance from the poultry ranges or buildings.

CAPILLARIA (hair worms)

This type of worm infestation is particularly severe in some areas but at present does not appear to be too wide-spread in the Northeast. These parasites are white and although may be an inch or so long, they are about the size of a coarse hair. They are found in the upper portion of the intestine and cause an inflammation of that portion of the gut. The lesions are often confused with the intestinal type of coccidiosis. The head of the parasite is buried into the intestinal lining and, since they are very small and covered with mucus, are extremely difficult to find unless a microscope is used. Treatment is usually not satisfactory. Some of the worms can be removed if the birds are given a capsule containing carbon tetrachloride.

EXTERNAL PARASITES

In the northeastern states the external parasites are pretty well limited to lice and mites. Occasionally mosquitoes and bedbugs and fleas are a problem on certain farms. The development of several new and effective insecticides within the past ten years has made it much easier to control these external parasites.

Lice

There are several kinds of lice found on chickens, but all of them are biting lice and not blood suckers. They feed upon flakes of skin, dried blood,

feathers and fecal material. They obtain moisture from the vent of the bird. The sexes are separate. The female attaches her eggs to the base of the feathers and the entire life cycle of the parasite may be spent on the bird. The young louse is mature and ready to produce eggs in about fifteen days after hatching.

Signs

Lousy birds are restless. They spend considerable time scratching themselves with their beaks and also in pulling out feathers. The feathers will be dry and broken and those about the vent are usually matted together with clusters of cream-colored louse eggs.

Control

If only a small pen of birds are involved they may be treated individually with nicotine sulphate or lindane on the roosts about one hour before the birds go to roost. The body heat of the roosting bird causes the material to vaporize and these liberated vapors kill the lice without harming the birds. Caution should be used so that none of the nicotine sulphate gets on the skin of the person applying the treatment. Do not use these compounds in extremely humid weather or in tightly closed buildings. The treatment does not kill the unhatched egg, therefore it should be repeated within ten to twelve days to get the new generation. Recently, the use of lindane in a fogging machine to produce a very dense fog in the poultry house has proved very satisfactory. This is quick, efficient, inexpensive and does not harm the feed in the pens or affect the birds.

Mites

The most important kind of mite found in this area is the common red mite. They are almost too small to be seen with the naked eye. These parasites are all blood suckers and live away from the bird except when feeding. Feeding usually takes place at night. During the daytime they can be found in great numbers in the cracks of the roosts and nests. Occasionally, large numbers of them will be found in old built-up litter.

Signs

One of the earliest signs of a mite infested poultry house is the finding of a large number of eggs on the floor. The birds will not use the mite infested nests. If the infestation is heavy, production and feed consumption will drop and in extreme cases the birds will appear pale and listless from loss of blood.

Control

In case of a heavy mite infestation it may be necessary to remove the birds from the pens and clean it thoroughly before any treatment is started. The nests and roosts should be taken apart and painted with a preparation designed to kill mites. Recently mites as well as lice, bedbugs

and fleas have been treated successfully with a lindane fog. The necessary equipment may be rented from commercial fumigating companies. Fogging should be done late in the afternoon so as not to contaminate the eggs with lindane.

Miscellaneous Conditions

BLUE COMB DISEASE (Avian Monocytosis)

This disease has been described under a variety of names. The exact cause of it is not known. It is primarily a disease of pullets just coming into production and is most often seen in August, September, and October. It has however been observed in chicks three weeks of age and in hens in their second laying year. It has also been reported for every month of the year. Blue comb has many characteristics of an infectious disease. If it makes its appearance on a farm it will usually develop in the other pens on that farm and even in the chickens of other ages. It may make its appearance on a farm within a few days after breeding cockerels from an outside source have been placed in the pens.

Signs

The first symptoms that affected birds show is an increased thirst. This is followed within a few hours by a greenish-grey diarrhea. Death may take place within 48 hours after the first symptoms are seen. In some severe outbreaks dead birds may be found on the nest or under the roosts without having been observed to have been sick. Other birds may be sick several days before dying or recovering. As much as 70% of the flock may be affected but it is unusual to have over 20% mortality. Birds dead of blue comb disease will have shrunk or withered shanks, comb and wattles. The comb and wattles will be very dark red or bluish, hence the term "blue comb." When the dead birds are opened and examined the breast muscle is observed to be very dark and somewhat sticky. The condition has been likened to fish flesh. The intestines will be inflamed and contain much greyish-green mucus. The liver will usually be enlarged and may contain many small yellowish areas. The kidneys will be swollen and pale. In some cases deposits of urates can be seen under the kidney capsule. In others small hemorrhages will be seen on the heart, gizzard and intestines. Any or all of these lesions may be seen in a single carcass. Death takes place because of kidney damage. Many of the sick birds that apparently recover die later because of the kidney damage that resulted from the original attack of blue comb disease.

Control

Since the cause of the disease has never been definitely determined, specific methods of prevention are not available. We do know that the first lesion to develop is an inflammation of the small intestine. This

inflamed organ will take up toxic materials that a normal intestine would not and once it is absorbed into the blood stream it must be eliminated through the kidneys. Too much toxic material will damage the kidneys and cause the death of the bird. If every effort is made to increase the water intake of the affected flock then much of the toxic material will be flushed out through the intestinal tract without being absorbed into the blood stream. This can be accomplished in a number of ways such as using molasses in the water, milk instead of water, wet mashers, flushing mashers, muriate of potash in the water or in the feed. Medicated water is preferable to medicated feed since the affected birds do not eat an adequate amount to do them much good.

Blue comb disease has been reported in turkeys. The symptoms are much the same as in chickens only more severe. Recently the use of some antibiotics has been reported to be of value in treating this disease in turkeys. Similar work in chickens has been reported.

VENT GLEET

The cause of vent gleet is not known. It is a disease which causes an inflammation and irritation of the vent and cloaca. It frequently follows the production of very large or double yolked eggs. This would lead one to suspect that an injury is the cause but there is some evidence that it is a contagious disease and can be transmitted from one hen to another by the breeding cockerel. Contaminated nesting material may also act as a spreader of the disease.

Signs

The first indications of vent gleet are an accumulation of feces and urates about the edge of the vent and on the feathers in that region. This is followed by straining and a prolapse of the cloaca. A very characteristic disagreeable odor is usually present. The prolapsed cloaca may cause cannibalism to start in the pen if that bird is left in there.

Control

First remove all visibly affected birds. Then clean and disinfect the nests. If the flock is mated it may be necessary to remove all cockerels. Individual treatment of affected birds is usually not indicated.

REPRODUCTIVE DISORDERS

A considerable number of laying birds will die each year and upon examination will show only disturbance or disfunction of the reproductive tract. This is especially noticeable in flocks that have gone through a prolonged heavy egg production period. Reproductive disorders are also encountered following the sudden interruption of egg production by such diseases as infectious bronchitis or Newcastle disease. Some of these disorders are: (1) ruptured yolks with secondary peritonitis, (2) internal lay-

ing, (3) prolapse of oviduct or cloaca, (4) salpingitis, (5) impacted oviduct and (6) tumors of the oviduct.

(1) The external signs of ruptured yolk and peritonitis are similar to those of blue comb or fowl cholera. The birds are toxic, the heads dark and congested and there is usually a diarrhea. The majority of the affected birds will die. The condition usually appears after a prolonged period of high production.

(2) Internal laying does not appear to be associated with an infection. After the eggs are formed they are forced out of the oviduct into the body cavity. As many as 12 to 15 soft-shelled eggs may be found in the body of a hen. In such cases the added weight causes the bird to walk upright like a duck.

(3) Prolapse of the oviduct or cloaca is the result of straining on the part of the hen. This may result from the laying of very large eggs or may be the result of some irritation of the vent such as vent gleet.

(4) Salpingitis is a non-specific infection of the oviduct. It is not common, but is usually fatal to the affected bird.

(5) Impacted oviducts are usually the result of some mild infection of the lower part of the duct. The developing egg adheres to the inflamed area and additional egg material and shell develops around it until a mass two to three inches in diameter and up to six inches long may be formed.

(6) Tumors may develop in the wall of the oviduct. If small, they may not cause any trouble, but if large, they may cause an impaction to the duct.

BLOOD or MEAT SPOTS

This is not a disease or a condition produced by a disease. Evidence at this time definitely shows that this is more severe in some strains within a breed than in others and that the amount of it can be reduced by careful selection and testing of the breeding stock. This can be done by trap-nesting the breeders and removing the ones producing the abnormal eggs. In some hens a drop or so of blood from the ripened ruptured yolk membrane may appear as the yolk leaves the ovary. This blood will accompany the yolk into the oviduct and be included in the egg. The blood may discolor the albumen or it may clot and is then referred to as a meat spot. Such eggs can be detected by candling. The meat spot does not necessarily mean that the egg is of low quality or that it will have poor hatchability. The consumer does not appreciate the added color and if too many eggs are found to be this way a change in egg supplier usually follows.

CANNIBALISM

All birds seem to be more or less cannibalistic. This may show up in the baby chick of a few days of age or any time thereafter. It is observed in

all strains and all breeds of chickens and turkeys. Cannibalism usually begins very suddenly and may cause severe losses. Good management practices will do much to eliminate the causes of cannibalism but is no guarantee that it will not occur.

Causes

Some of the factors that are believed to be predisposing to cannibalism are overcrowding, insufficient feeder and water space, housing of different aged birds together and failure to see sick or weak birds.

Control

The first step is to correct any management practice that may be at fault. It is usually necessary to either debeak the flock or to use some type of "pick guard." The application of pick guards, specs or debeaking to laying hens will result in a temporary drop in egg production. On farms where cannibalism is more or less of a constant problem, the anti-picking and debeaking devices should be used on the pullets at the time of housing and before the birds are in full production.

Other methods which have been used with some measure of success are the feeding of scratch grain in the litter, feeding of whole oats, increasing the salt content of the diet, feeding Wirthmore Fitting Ration, baled leafy alfalfa or clover hay or the placing of pine boughs in the pens.

KERATO-CONJUNCTIVITIS (Blindness)

During the past few years a number of cases of an unexplainable blindness have been observed in the Northeast. These cases were always in confined birds and usually occurred in the wintertime. A small roughened area would appear on the eye. This apparently was very painful as the bird would keep the eye closed. Such birds would lose flesh rapidly and usually die. All attempts to transmit the condition from one bird to the other failed. Research workers at the University of New Hampshire and the University of Connecticut have shown that this condition could be produced by prolonged exposure to ammonia vapors. There are no internal signs of this disease and treatment would be limited to the use of suitable eye ointments or wash in the affected eye. Prevention is proper ventilation of the poultry house to remove the ammonia. The removal of the droppings will also aid in reducing the ammonia and moisture. Some immediate relief can be had by mixing a liberal amount of superphosphate in the litter and on the droppings.

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MEMORANDUM

MEMORANDUM

MEMORANDUM

MEMORANDUM



SIGN OF QUALITY

- FULL VALUE
- QUALITY CONTROLLED
- EXPERIMENTALLY TESTED
- DEPENDABLE SERVICE

"SERVING AGRICULTURE SINCE 1886"